CHRISTMAS NUMBER WITH FREE 48-PAGE BOOK

Wireless Magazine

1/-

DECEMBER 1933

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Wireless Magazine

The Best Shillingsworth in Radio

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Introducing Our Christmas Number

THIS is a Christmas Number, more varied in its appeal than ever, and as practically useful as the experience of a skilled staff can make it.

Our free supplement book, "Choosing Your New Radio," contains 48 pages in which are listed, in order of price, just over 150 sets. Without waste of space you are told just what you need to know about the principal sets on the market and if you cannot find in this book something to suit you, you will indeed be hard to please. Keep the book by you for reference.

There is a strong Christmas flavour to this issue; so there ought, you answer, but as G. K. Chesterton might remark about so many Christmas issues, what one most notices about them is that they are seldom "Christmassy."

We give you this month the dear old subject of the Christmas ghost—but from the radio point of view. "The theory is being rapidly developed," says our author, "that the brain operates by an electro-chemical process and that any intense thought action may result in a corresponding electro-chemical, electro-magnetic or even radio electric action which can be detected by electrical and mechanical means." And so he manufactures a scientific ghost. Well, there you are!

There is the return of our old and foolish friend, Fish-glue, with his "Stuff and Nonsense"—more nonsensical and less "stuffy" than ever.

Christmas was always the criminal's opportunity as well as the philanthropist's, and with this in mind L. A. Chapman shows how radio plays its part in the tracking of the mobile crook. Many other features in this number will remind you that Christmas is a-coming.

Even the title of our four-valve A.C. super is the Merrymaker; evidently, the set's function is to assist in bringing Christmas cheer to your fireside. It is a set designed by S. Rutherford Wilkins and the "W.M." Technical Staff; its speciality is automatic volume control, and a neat style of chassis construction. It makes the best possible use of certain new valves and has complete freedom from second-channel interference. In an independent test—not conducted by our staff—this set picked up over fifty stations.

In addition to this A.C. super-het we have what I might term a "request" set. It is the Class-B Quadradyne, based on a set we introduced twenty-two months ago—the very successful Quadradyne. We have added two screened-grid stages and class-B, and there is one-knob control to four tuned circuits. A thoroughly good set which anybody can work, and specially designed for economical running.

To see ourselves as others see us is not always easy and when we can do so we cannot be sure that the view will please us. In the article "The 'Low-down' on the B.B.C." an American broadcaster looks at the British institution and tells us what he thinks of it. His article is first-rate reading, generously pointing out what he thinks good and frankly indicating some weaknesses. I am sure the B.B.C. itself will read the article, not only with amusement, but with a desire to learn the other man's point of view.

Of our technical features other than sets this month, I may indicate Noel Bonavia-Hunt's "Real Quality," in which the author makes some pertinent suggestions; Percy W. Harris's "Using Tone and Volume Controls," well-informed and popularly written; the James's article, "How the Expert Gets things Right," things to do and not to do; and P. Wilson's "Mechanical Circuit Diagrams," authoritative and provocative of thought.

In this Christmas Number you will find all our usual features—the record reviews, the test reports on manufactured sets, etc., etc., and you will remember—you will particularly remember in this month when people are more prone than at other times to treat themselves to a new set—that we give free advice to prospective set buyers. Tell us what you wish to pay, your locality, etc., etc. (you will see on page 513 what we want to know), and we will immediately advise you by post as to the sets that come nearest to your requirements.

Let me wish you very cordially the compliments of the season.

B. E. J.

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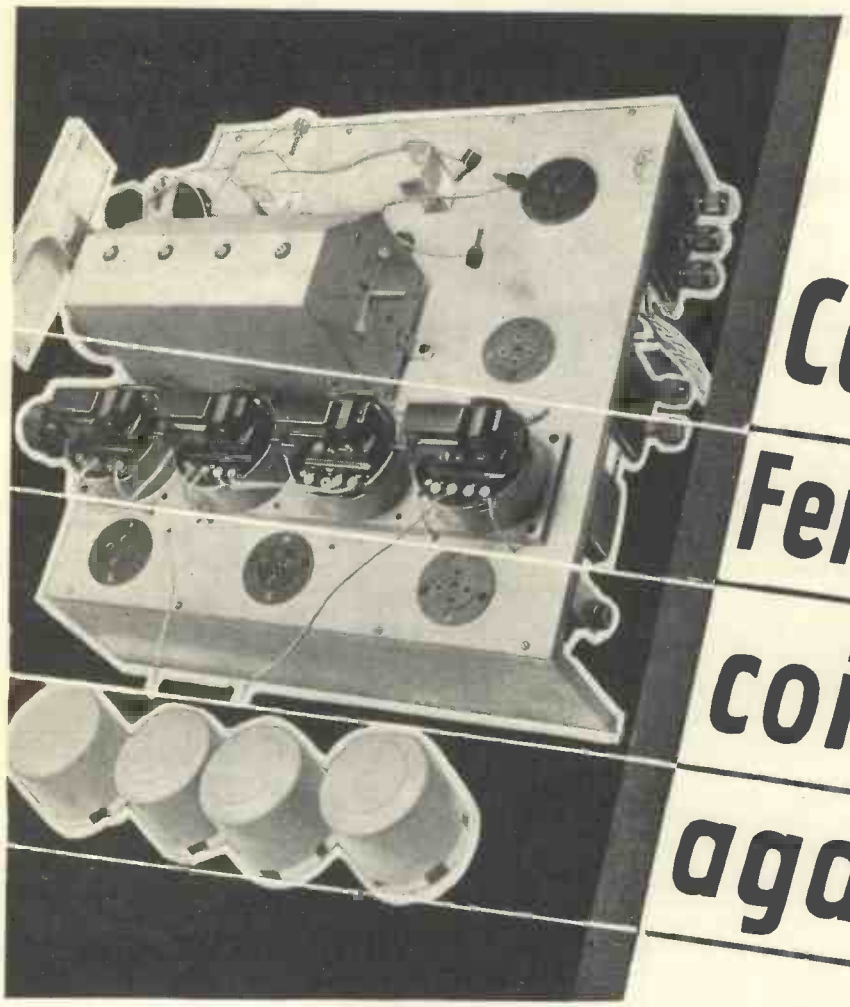

Colvern Ferrocart coils again

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Why not bring your Quadradyne into the 1934 category by fitting Ferrocart Coils . . . the increased selectivity, volume and efficiency will be a revelation to you.

Here are the types for the Quadradyne : F.10, F.11, F.12, F.13, at **50/-** per set.

If you are constructing W. James' SUPER STRAIGHT SIX use the same coils as the designer—Ferrocart. The following types are supplied : 1 Pair F.1, F.2, Ganged ; 1 Pair, F.14, Ganged, at **50/-** per complete set of 4 Coils.

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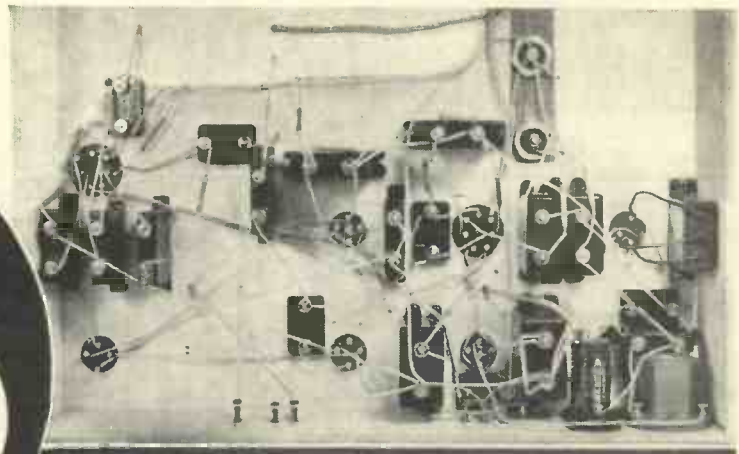

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1—1 *megohm*	1—100,000 *ohms*	1—30,000 *ohms*	2—5,000 *ohms*	1—350 *ohms*
1—2 *megohms*		2—25,000 *ohms*		1—300 *ohms*

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AND AT MANCHESTER.

Guide to the World's Broadcasters

Specially Compiled for "Wireless Magazine" by JAY COOTE

Metres : 31.55 **CARACAS (YV3BC)** *Kilocycles : 9,510*
Power : 200 watts
Venezuela

Distance from London: Approximately 4,200 miles.

Standard Time: Greenwich Mean Time, less 4½ hours.

Announcer: Man.

Call: "Aqui Radio Difusoria Venezolana."

Language Used: Spanish and English.

Daily Transmissions: G.M.T. 02.00-02.30. On Sundays broadcasts are extended a further half hour. Programmes are relayed from the medium-wave station working on 250 metres (1,200 kilocycles).

Broadcasts are also made on 48.92 metres (6,132 kilocycles) daily from G.M.T. 15.00-18.00 and from 21.00-02.00; on Sundays from G.M.T. 13.00-16.30; 19.30-22.30, and from midnight to 02.00.

Metres : 73 **QUITO (HCJB)** *Kilocycles : 4,110*
Power : 200 watts
Ecuador

Distance from London: Approximately 5,000 miles.

Standard Time: Greenwich Mean Time, less 5¼ hours.

Announcer: Man.

Languages Used: Spanish and English.

Call: In Spanish, followed by "This is Station HCJB, Quito Ecuador operating on 4,110 kilocycles."

Interval Signal: Two-tone chime.

Daily Transmissions (except Tuesday) : G.M.T. 01.15-02.45.

Metres : 42.92 **JELÖY (LCL)** *Kilocycles : 6,990*
Power : 0.5 kw. (temporary)
Norway

Distance from London: Approximately 710 miles.

Standard Time : Central European (G.M.T., plus 1 hour).

Announcer: Man.

Call: "Hallo Oslo (phon. : Ou-zlo) her."

Opening Signal: First four bars of National Anthem.

Interval Signal: Six notes *ad lib.*

Relay programmes from Oslo.

Closes down with the words "Hermed er programmet slutt for i dag (With this item we conclude to-day's programme). Godnatt Godnatt."

Metres : 23.39 **RADIO MAROC (CNR)** *Kilocycles : 12,825*
Power : 2.5 kw.
Rabat, Morocco

Distance from London: Approximately 1,260 miles.
Standard Time: Greenwich Mean Time (Morocco does *not* adopt summer time when change over is made in France).
Announcers: Man and woman.
Call: "Allô ! Allô ! Ici la Station de Radiodiffusion de l'office Chérifien de Radio Maroc a Rabat"; between items : "Ici Radio Maroc."
Interval Signal: Metronome (sixty beats per minute).
Relays the programme from the studio of the medium-wave broadcasting station at Rabat (416 metres).
Sunday transmission *only* at G.M.T. 12.30.
Closes down as other French stations with the playing of *La Marseillaise.*

Metres : 220.1 **BEZIERS** *Kilocycles : 1,363*
Power : 0.3 kw.
France

Distance from London: Approximately 573 miles.
Standard Time: Greenwich Mean Time (France adopts B.S.T.).
Announcer: Man.
Language: French only.
Call: "Allô ! Ici Radio Béziers (Bay-zee-aye) (Station de Propagande pour le Vin").
Interval Signal: Crowing of a cockerel.
Main Daily Programme: G.M.T. 20.15. market quotations of wines and alcohol topical news concert; 21.00 talks; 21 30 gramophone records, dance music, or studio dramatic performance. On Sundays concert only at 20.30.
Closes down with the interval signal, usual French good-night greetings, followed by *La Marseillaise.*

Metres : 574.7 **LJUBLJANA** *Kilocycles : 522*
Power : 7 kw.
Yugoslavia

Distance from London: Approximately 763 miles
Standard Time: Central European (G.M.T., plus 1 hour).
Language Used: Slovene.
Announcer: Man.
Call: "Hallo ! Radio Ljubljana (phon. : Loo-blee-yah-nah)."
Interval Signal: Cuckoo call.
Main Daily Programmes: G.M.T. 07.15, news, physical exercises; 08.00, sacred service (Sundays); 12.15, gramophone records, news, time signal, then almost continuous broadcast from 17.00 (talks); 18.30, news for foreigners; 19.00, main evening entertainments; 20.30, news, late concert or dance music.
Relays Zagreb programme every Monday or Tuesday and entertainments from Belgrade on Fridays. When such exchanges are effected the principal announcements are usually given in the Slovene, Serbian, French, and German languages.
Good Night: "Lakho noc."

Metres : 236.2 **RADIO SUD-OUEST** *Kilocycles : 1,270*
Power : 3 kw.
Bordeaux, France

Distance from London: Approximately 462 miles.
Standard Time: Greenwich Mean Time (France adopts B.S.T.).
Language: French only.
Opening Signal: Gramophone record (trumpet fanfare by the *Garde Republicaine*).
Call: "Allô ! Allô ! Ici Radio Sud-Ouest à Bordeaux (phon. Bor-do)."
Interval Signal: One note on a dulcimer struck after each item in programme.
Main Daily Transmissions: G.M.T. 11.30, organ recital (Sundays), concert (weekdays); 12.00, orchestra or gramophone records; 18.30, gramophone records, news, talks on local topical subjects.
Closes down as other French stations, concluding with *La Marseillaise* or a local patriotic melody

Metres : 312.8 **CRACOW** *Kilocycles : 959*
Power : 1.5 kw.
Poland

Distance from London: Approximately 878 miles.
Standard Time: Central European (G.M.T., plus 1 hour).
Announcers: Man and woman.
Languages Used: Polish and occasionally French.
Call: "Hallo ! Hallo ! Polskie Radjo Cracow (phon. : Krarkoof)."
Opening Signal: Chimes from the Church of Notre Dame at Cracow.
Interval Signal: Three notes. When relaying Warsaw, short Chopin melody.
Main Daily Transmissions: Mostly relays Warsaw, but local broadcasts are carried out at G.M.T. 09.55, 12.05, 14.00, 16.30; at 19.45 details are given of next day's programme.
Closes down with the words "Dobra noc panstvom (Good-night, everybody)," followed by a trumpet call and the Polish National Anthem.

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WORLD'S BROADCAST WAVELENGTHS

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

Wave-length	*Name of Station*	*Dial Readings*	*Country*
13.93	W8XK, Saxonburg		United States
13.95	Chicago W9XF		United States
13.97	Daventry GSH		Great Britain
13.979	Coytesville W2XAL		United States
13.997	Boston WIXAL		United States
14.47	**Buenos Aires LSY**		Argentine
14.56	Bandoeng PMB		Java
14.97	Leopoldville OPL		Belgian Congo
15.48	Prangins HBL		Switzerland
15.5	Buenos Aires L5Y		Argentine
15.625	Ruysselede (Bruges) ORG		Belgium
15.92	Bandoeng PLE		Java
16.1	**Rugby** GBU		Great Britain
16.36	Lawrenceville (N.J.) WLA		United States
16.38	**Rugby** GAS		Great Britain
16.57	Chicago W9XAA		United States
16.66	Rocky Point WAJ		United States
16.7	**Buenos Aires LSY**		Argentine
16.81	Bandoeng PLF		Java
16.85	Kootwijk PCV		Holland
16.86	Daventry Empire GSG		Great Britain
16.878	**Boundbrook** W3XAL		United States
16.878	Downer's Grove W9XAA		United States
16.88	**Eindhoven** PHI		Holland
16.89	Königswusterhausen DJE		Germany
16.98	New Brunswick W2XAO		United States
19.36	Kemikawoa (Tokio) JIAA		Japan
19.56	**Schenectady** W2XAD		United States
19.61	La Paz CP4		Bolivia
19.646	**New York** W2XE		United States
19.67	Coytesville N.J. W2XAL		United States
19.68	**Radio Coloniale** FYA		France
19.72	**Saxonburg** W8XK		United States
19.737	**Zeesen** DJB		Germany
19.815	Daventry (Empire) GSF		Great Britain
19.84	Rome (Vatican) HVJ		Italy
19.85	Tashkend (RAU)		U.S.S.R.
19.88	Moscow (RKI)		U.S.S.R.
19.99	Central Tuinucu CM6XJ		Cuba
20.03	Manila KAY		Philippine I.
20.27	Rocky Point WQV		United States
20.49	Deal (N.J.) WND (W2XBJ)		United States
20.5	Chapultepec XDA		Mexico
20.7	Rocky Point WKJ (WEB)		United States
20.97	Amateur Band		—
21.45	Rocky Point WQB		United States
21.83	Drummondville CGA		Canada
21.92	Szekesfehervar HAS2		Hungary
22.26	Rocky Point WAJ		United States
22.35	Rocky Point WHR		United States
22.68	Ships		—
22.7	Zeesen (DHB)		Germany
23.39	**Radio Maroc (Rabat)**		Morocco
24.41	Rugby GBU		Great Britain
24.9	Kootwijk PDV		Holland
25.16	Moscow RW59		U.S.S.R.
25.24	Chicago W9XF		United States
25.25	Radio Coloniale, Paris (FYA)		France
25.27	**Saxonburg (Pa)** W8XK		United States
25.284	**Daventry (Empire)** GSE		Great Britain
25.34	Chicago (Ill.) W9XAO		United States
25.36	New York W2XE		United States
25.4	**Rome** 2RO		Italy
25.42	Boston WIXAL		United States
25.51	**Zeesen DJD**		Germany
25.532	**Daventry (Empire)** GSD		Great Britain
25.57	**Eindhoven** (PHI)		Holland
25.6	Winnipeg VE9JR		Canada
25.63	Radio Coloniale FYA		France
26.83	Funchal CT3AQ		Madeira
27.89	Marapicu		Brazil
28.28	Rocky Point (N.J.) WEA		United States
29.04	Ruysselede ORK		Belgium
29.16	Zeesen (DIQ)		Germany
29.6	Marapicu PSD		Brazil
30.0	Radio Excelsior LR5		Argentine
30.0	Madrid EAQ		Spain
30.77	Lawrenceville WOF		United States
30.89	**Rugby** GCA		Great Britain
31.25	Lisbon CTIAA		Portugal
31.25	Mexico City, XETE		Mexico
31.28	**Philadelphia** W3XAU		United States
	Sydney VK2ME		New South Wales
31.297	**Daventry (Empire)** GSC		Great Britain
31.32	**Radio Nations** HBI.		Switzerland
31.35	**Springfield W1XAZ**		United States
31.38	**Zeesen** DJA		Germany
31.48	**Schenectady W2XAF**		United States
31.545	**Daventry (Empire)** GSB		Great Britain
31.55	Melbourne VK3ME		Victoria
31.56	Caracas YV3BC		Venezuela

Wave-length	*Name of Station*	*Dial Readings*	*Country*
31.6	Poznan (SRI)		Poland
31.71	Rocky Point WKJ		United States
32	Heredia T14NRH		Costa Rica
32.71	**Lawrenceville** WND		United States
33.26	Rugby GBS		Great Britain
33.59	Rocky Point (N.J.) WEC		United States
34.68	Lo don (VE9BY)		Canada
35.0	Khabarovsk (RV15)		U.S.S.R.
36.88	bagdad YID		Iraq
37.33	Rabat (CNR)		Morocco
38.47	**Radio Nations** HBP		Switzerland
38.65	Kootwijk PDM		Holland
39.9	Moscow (RKI)		U.S.S.R.
40.3	Radio Nations HBQ		Switzerland
40.54	Rocky Point WEM		United States
41.1	Amateur Band		—
41.6	Las Palmas EAR58		Canary Isles
41.7	Singapore VSIAB		Sts. Settlements
41.9	Manizales (HJ4ABB)		Colombia
42.92	Jelöy LCL		Norway
43.0	Madrid EAR 110		Spain
44.61	Rocky Point WQO		United States
45	Constantine FM8KR		Tunis
45.38	Moscow		U.S.S.R.
45.31	Rio Bamba PRADO		Ecuador
45.38	Moscow RW72		U.S.S.R.
46.67	London (Ont.) VE9BY		Canada
46.69	Boundbrook W3XL		United States
48	**Casablanca** CN8MC		Morocco
48	Bogoto HJ3ABF		Colombia
48.05	Baranquilla (HKD)		Colombia
48.8	Winnipeg VE9CL		Canada
48.86	**Saxonburg (Pa.)** W8XK		United States
48.9	Moscow (RKK)		U.S.S.R.
48.9	Kuala Lumpur ZGE		F.M.S.
48.92	Caracas YV3BC		Venezuela
48.94	Mexico XETE		Mexico
48.92	New York W2XA		United States
48.95	Maracay YV11BMO		Venezuela
49.0	Johannesburg ZTJ		Sth. Africa
49.02	New York W2XE		United States
49.08	**Caracas** YV1BC		Venezuela
49.1	Halifax VE9HX		Canada
49.1	Calcutta VUC		Br. India
49.18	**Boundbrook** W3XAL		United States
49.18	Chicago W9XF		United States
49.2	Shanghai DUOK		China
49.22	Bowmanville VE9GW		Canada
49.3	La Paz CP5		Bolivia
49.34	Chicago W9XAA		United States
49.4	Skamlebaek OXY		Denmark
49.43	Vancouver VE9CS		British Columbia
49.5	**Philadelphia** W3XAU		United States
	Havana CMCI		Cuba
	Cincinnati W8XAL		United States
	Nairobi VQ7LO		Kenya Colony
49.586	**Daventry (Empire)** GSA		Great Britain
49.67	Boston (WIXAL)		United States
49.67	**Miami Beach** W4XB		United States
49.87	Mexico (XEW)		Mexico
49.83	Chicago W9XF		United States
	Zeesen DJC		Germany
49.96	**Drummondville** VE9DR		Canada
49.96	Tegucigalpa (HRB)		Honduras
50	**Moscow** RNE		U.S.S.R.
50.26	**Rome (Vatican)** HVJ		Italy
51	St. Denis		Reunion
52.7	Tananarive FIQA		Madagascar
54.52	New York W2XBH		United States
56.9	Konigswusterhausen (DTG)		Germany
57.03	**Rocky Point** WQN		United States
58.03	Bandoeng PMY		Java
58.31	**Prague**		Czechoslovakia
62.5	**Long Island (N.J.)** W2XV		United States
62.56	London (Ont.) VE9BY		Canada
65.93	Rocky Point WAD		United States
68.18	Moscow (RFCK)		U.S.S.R.
70.2	Khabarovsk RV15		U.S.S.R.
73	Quito (HCJB)		Ecuador
76.0	Maracay (YV11AM)		Venezuela
79.5	Salisbury ZEA		South Africa
84.5	Berlin D4AGE		Germany
202.3	Liege (Wallonie)		Belgium
209.8	Magyarovar		Hungary
	Pecs		Hungary
	Miskolcz		Hungary
211.3	**Newcastle**		Great Britain
	Antwerp		Belgium
214.3	Warsaw (No. 2)		Poland
	Aberdeen		Great Britain
215.6	Chatelineau		Belgium

WORLD'S BROADCAST WAVELENGTHS

Continued from page 456

Wavelength	*Name of Station*	*Dial Readings*	*Country*
217.1	**Königsberg**		Germany
	Brussels		Belgium
	Dublin		Irish Free State
218.5	Salzburg		Austria
	Plymouth		Great Britain
220.3	Beziers		Belgium
223.2	Liege Cointe		Belgium
224	**Cork**		Irish Free State
225.9	**Fécamp**		France
227.4	Flensburg		Germany
231	Malmö		Sweden
231.7	Kiel		Germany
235	Lodz		Poland
235.5	Kristianssand		Norway
236	**Bordeaux-Sud-Ouest**		France
238	Nimes		France
239	**Nurnberg**		Germany
240.6	Stavanger		Norway
242.3	**Belfast**		Ireland
244.1	Basle		Switzerland
245.9	Linz		Austria
	Schaerbeck		Belgium
	Berne		Switzerland
247.7	**Trieste**		Italy
249.4	**Juan-les-Pins**		France
250.9	Barcelona EAJ15		Spain
253.1	**Gleiwitz**		Germany
254.7	Toulouse PTT		France
257.3	**Hörby**		Sweden
259.3	**Frankfurt**		Germany
261.6	**London National**		Great Britain
	West National (Tests)		Great Britain
263.8	**Moravska Ostrava**		Czechoslovakia
265.4	**Lille**		France
267.6	Valencia		Spain
269.5	Bremen		Germany
269.8	**Bari**		Italy
271.2	**Rennes**		France
273.7	**Turin**		Italy
276.5	**Heilsberg**		Germany
279.7	**Bratislava**		Czechoslovakia
281	**Copenhagen**		Denmark
283.6	Berlin		Germany
	Innsbruck		Austria
	Magdeburg		Germany
	Stettin		Germany
284.7	Radio Lyons		France
286	Montpellier		France
288.5	Bournemouth		Great Britain
	Scottish National		Great Britain
291	Lisbon CT1AA		Portugal
291	Viipuri		Finland
293	Kosice		Czechoslovakia
294.2	Limoges PTT		France
296.1	**Hilversum**		Holland
298.8	Tallinn		Esthonia
301.5	North National		Great Britain
304.3	**Bordeaux** PTT		France
307	Falun		Sweden
307.1	Zagreb		Yugoslavia
307.7	Vitus-Paris		France
309.9	West Regional		Great Britain
312.5	Genoa		Italy
312.8	Cracow		Poland
315	Marseilles		France
318.8	Naples		Italy
	Sofia		Bulgaria
	Dresden		Germany
320	Naples		Italy
321.9	**Goteborg**		Sweden
325	**Breslau**		Germany
328.2	**Poste Parisien**		France
331.6	**Milan**		Italy
335	Poznan		Poland
338.2	**Brussels (No. 2)**		Belgium
341.3	**Brno**		Czechoslovakia
345.2	**Strasbourg**		France
350	Barcelona EAJ1		Spain
352.1	Graz		Austria
355.9	**London Regional**		Great Britain
358	Tiraspool		U.S.S.R.
360.6	Stuttgart (temp.)		Germany
363.6	Algiers		North Africa
364.1	Bergen		Norway
	Bolzano		Italy
368.1	Frederikstaad		Norway
	Helsinki		Finland
	Kharkov		U.S.S.R.
	Seville		Spain
369.5	Radio LL		France
372.2	Hamburg		Germany
376.4	**Scottish Regional**		Great Britain

Wavelength	*Name of Station*	*Dial Readings*	*Country*
381.7	Lvov		Poland
385.1	Radio Toulouse		France
389.6	**Leipzig**		Germany
394.2	**Bucharest**		Roumania
398.9	**Midland Regional**		Great Britain
403	**Sottens**		Switzerland
408.7	**Katowice**		Poland
413	**Athlone**		Irish Free State
416	Radio Maroc		North Africa
419.9	Berlin		Germany
424.3	Madrid (Espana)		Spain
	Moscow-Stalin		U.S.S.R.
	Madrid EAJ7		Spain
429.8	Belgrade		Yugoslavia
435.4	Makhatch-Kala		U.S.S.R.
	Stockholm		Sweden
441.2	**Rome**		Italy
447.1	**Paris PTT**		France
	Dantzig		Dantzig
451	Agen		France
452	Madona		Latvia
452.8	Milan Vigentino		Italy
453.2	Klagenfurt		Austria
	Odessa		U.S.S.R.
	Porsgrund		Norway
456.6	San Sebastian		Spain
459.4	**Beromuenster**		Switzerland
465.8	**Lyons PTT**		France
472.4	**Langenberg**		Germany
476.9	Lisbon (tests)		Portugal
480	**North Regional**		Great Britain
488.6	**Prague**		Czechoslovakia
495.9	Trondheim		Norway
500.8	**Florence**		Italy
501.7	Gorky		U.S.S.R.
509	Astrakhan		U.S.S.R.
509.3	**Brussels No. 1**		Belgium
518.1	**Vienna**		Austria
527	Riga		Latvia
532.9	**Munich**		Germany
539.8	Palermo		Italy
542	**Sundsvall**		Sweden
550	**Budapest**		Hungary
559.7	Tampere		Finland
	Kaiserslautern		Germany
	Augsberg		Germany
563	Wilno		Poland
566	Hanover		Germany
569.2	Freiburg		Germany
570.3	Grenoble		France
577.5	Ljubljana		Yugoslavia
720	Moscow PTT		U.S.S.R.
750	**Geneva**		Switzerland
770	Ostersund		Sweden
779.2	Petrozavodsk RV29		U.S.S.R.
833	**Heston Airport**		Great Britain
840	Budapest (2)		Hungary
857.1	Leningrad		U.S.S.R.
882	Saratov		U.S.S.R.
900	Moscow		U.S.S.R.
937.5	Kharkov		U.S.S.R.
1,000	**Moscow**		U.S.S.R.
1,034	Kiev		U.S.S.R.
1,060	**Scheveningen-Haven**		Holland
1,071	**Tiflis**		U.S.S.R.
1,083	**Oslo**		Norway
1,105	Minsk		U.S.S.R.
1,131	Monte Ceneri (tests)		Italy
1,153.8	**Kalundborg**		Denmark
1,190	**Luxembourg**		Luxembourg
1,200	Reykjavik		Iceland
	Istanbul		Turkey
1,229	Boden		Sweden
1,255	Vienna		Austria
1,304	**Moscow**		U.S.S.R.
1,355	**Motala**		Sweden
1,380	Novosibirsk		U.S.S.R.
1,411.8	**Warsaw**		Poland
1,445.8	**Paris (Eiffel Tower)**		France
1,481	Moscow (RV1)		U.S.S.R.
1,538	Ankara		Turkey
1,554.4	**Daventry National**		Great Britain
1,635	**Deutchlandsender**		Germany
1,725	**Radio Paris**		France
1,796	**Lahti**		Finland
1,875	**Kootwijk**		Holland
	Moscow		U.S.S.R.
1,910	Svendlovst		U.S.S.R.
1,935	**Kaunas**		Lithuania
2,625	Königswusterhausen		Germany
2,650	**Eiffel Tower**		France

This complete list of broadcasting stations covers the ultra-short, short, medium and long waves. Names shown in heavy type are not necessarily an indication of high power, but show that these particular stations are well heard in this country, and can be depended upon for reliable reception.

Better 'Class B' with..

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Marconi B21 brings better 'Class B' performance to all battery sets because of these important features:

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Marconi VP21	—The first Variable-Mu battery H.F. pentode, for all up-to-date circuits	15/6
Marconi S24	—High Efficiency straight screen grid	15/6
Marconi VS24	—High slope Variable-Mu screen grid	15/6
Marconi HL2	—Non-microphonic triode detector	7/-
Marconi L21	—High Efficiency Class B Driver for normal use	7/-
Marconi LP2	—Power valve and Class B Driver for sets where full output is needed	8/9

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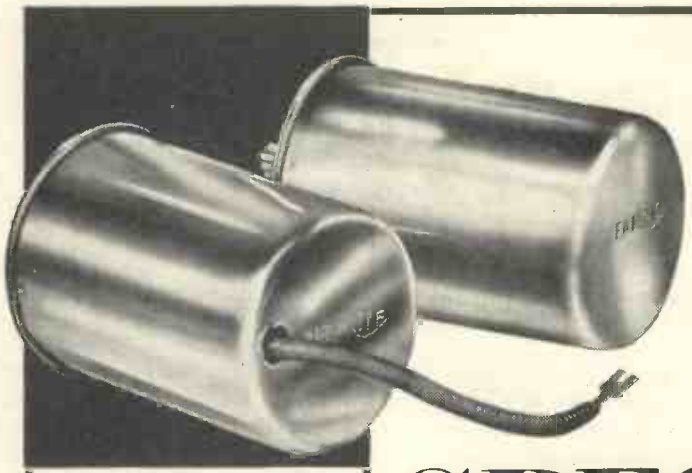

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TYPE BJ21 ... ... **8/6**

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Wearite again feature in an important specification. The famous OT1 and OT2 Intermediates are again selected, the highly efficient T21A mains transformer is selected . . . and now the NEW Wearite GN3 Three Coil Chassis. This is a Super-het unit, with bandpass and oscillator coils, *specially* designed for use with Pentagrid Valves. Its padding condensers and trimmers are integral parts of the unit—permitting the use of a standard 3-gang condenser. Thus, again Wearite have built a special job for special conditions. Whatever your component need . . . consult Wearite first.

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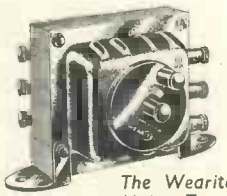
One Wearite GN3 3-Coil Unit **30/-**

This unit consists of 1st and 2nd Bandpass and Oscillator Coils, and is specially designed for use with Pentagrids.

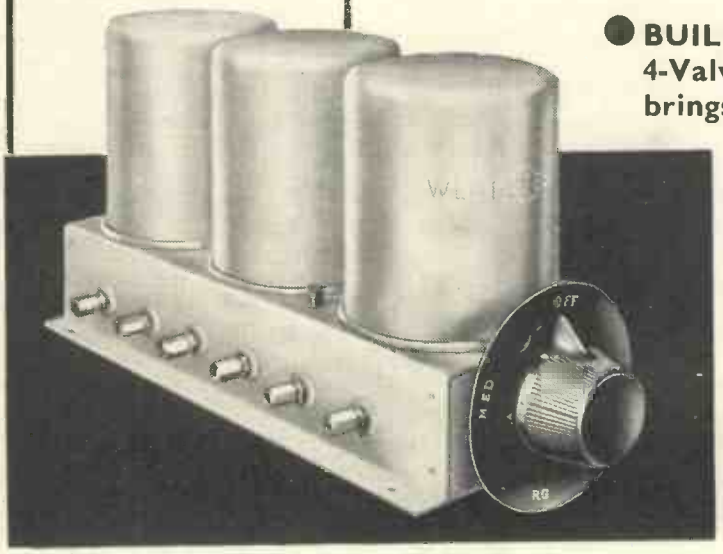
One Wearite HFS H.F. Choke **4/6**

One Wearite T21A Mains Transformer **25/-**



The Wearite T21A Mains Transformer

The Wearite GN3 Coil Chassis



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♡ 4004

ON THE CREST OF THE WAVES

Radio News from All the World :: By JAY COOTE

GERMANY

THERE would appear to be a strong possibility that a new site may have to be found for the 150-kilowatt transmitter which is to replace the *Deutschlandsender*, now at Zeesen.

The authorities are anxious that its broadcasts should be heard at good strength throughout the country and also that the programmes should be made available to listeners in neighbouring states. For this reason efforts will be made to find a favourable position for the station in a more central spot than the neighbourhood of the capital.

◆ ◆ ◆

A complete reorganisation of the German broadcasting net is taking place. Not only is the power of existing transmitters being increased, but new stations, and in particular relays, are being rebuilt in various parts of the country to ensure better reception.

At the same time a regrouping of some of the transmitters has been effected. Cassel, previously working on a common wavelength (245.9 metres) has been synchronised to broadcast on the same channel as Frankfurt-am-Main and Trier (Treves), and to which Freiburg, in its new guise as a 10-kilowatter, will be added in 1934. Hanover, now 1½ kilowatts, uses the same wavelength as Flensburg, and Bremen, of which the tests are being heard after programme hours, has also increased its power threefold.

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Finally, mobile transmitters are testing sites in South Germany and in Pomerania, for three additional relay stations. It is anticipated that one will be built at Coblence to take the Frankfurt-am-Main programmes, another at Wurzburg, to work with Munich, and a third somewhere in Pomerania, to be attached to the Northern Hamburg group, when Kiel will close down. Barring the U.S.S.R., when these plans are completed Germany will possess more transmitters than any other European state.

GRAND DUCHY

The 200-kilowatt transmitter at Yunglinster taking the Radio Luxembourg programmes is still operating on 1190.5 metres.

According to plan, it broadcasts musical entertainments destined to listeners of several European states, and the rota for the next few months has been fixed as under: Great Britain (Sunday); Italy (Monday); France and Belgium (Tuesday and Saturday); Germany (Wednesday and Thursday). Occasionally a special evening is devoted to entertainments in the Luxembourg dialect.

In addition to the evening transmissions the station now gives a lunch-hour recital of gramophone records between 12.30 and 2 p.m. daily. Extensive news bulletins in both French and German are also put out at intervals during the evening hours.

◆ ◆ ◆

GREECE

Every effort is to be made to take the initial step towards the establishment of a State broadcasting system. It is now proposed to erect a station in the neighbourhood of Athens which, while capable of undertaking the usual traffic for the aviation services, would at other times be at the disposal of programme organisers for the transmission of wireless entertainments.

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HOLLAND

The little Bloemendaal station recently celebrated its fifth anniversary. Situated in a suburb of Haarlem, it only broadcasts on Sundays. The programme consists of relays of sacred services from a Protestant church in that city. The power of the transmitter is only 200 watts, and the wavelength 245.9 metres, but on more than one occasion reception of this "toy" broadcaster has been reported from listeners on the east coast of England.

◆ ◆ ◆

On frequent occasions and in particular on Saturday evenings, listeners may have heard the V.A.R.A. broadcasts close down to the melody of the Soviet Anthem ("Internationale"). This programme organisation must now seek another melody with which to conclude its entertainments, as the Dutch authorities have now forbidden the use of the Communist hymn.

◆ ◆ ◆

ITALY

Little by little the Italian studios are being merged into two groups to permit an economy in programmes and also to facilitate simultaneous broadcasts from one common centre Bari (269.8 metres), which so far has been working entirely on its own, has been connected by landline with Rome and thus takes the bulk of its entertainments from the capital or from Naples.

In the course of a few months Palermo in the south will link up with the same network.

Milan, Turin, Trieste, Genoa and Florence form the *Nord Italia* or Northern group of studios, leaving for the time being Bolzano to its own independent resources.

◆ ◆ ◆

MEXICO

There is every probability that this winter will give us an opportunity of hearing a number of South American transmissions, and in particular broadcasts from Mexico, as the power of a number of stations is being appreciably increased.

Of the transmissions likely to be logged note should be made of the following : XEN, 422.3 metres (711 kilocycles), 150 kilowatts; XEM, 454.6 metres (660 kilocycles), 500 kilowatts; XETM, 355 metres (845 kilocycles), 150 kilowatts; all at Matamoros, on the United States—Texas border. XENT, Nueva Laredo, 270.1 metres (1,115 kilocycles), 150 kilowatts; XET, Monterrey, 434.8 metres (690 kilocycles), 500 kilowatts; XEF, 450.9 metres (665 kilocycles), 500 kilowatts; and XER, 407.9 metres (735 kilocycles), 500 kilowatts, both at Villa Acuna (Coahuila).

Continued on page 464

ON THE CREST OF THE WAVES—*Continued*

The recent Wavelength Conference, held at Mexico City, to which delegates from the United States, Canada, Cuba, and some South American States were sent, did not result in a satisfactory agreement, and was indefinitely postponed.

As will be seen, some slight readjustment in the wavelengths of the Mexican stations is being carried out, but this has only been done to cope with local conditions.

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NORTH AFRICA

Algiers is now nearer to getting its 75-kilowatt transmitter than it was two months ago, as in the meantime the local authorities have voted a law on lines similar to that passed in France and by which the listener will now be compelled to take out a licence.

On the strength of the income to be derived from this source, the Administration of Posts and Telegraphs has secured a vote of three million francs towards the cost of the new station.

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NORWAY

To provide a broadcasting service for the Finmark district of Norway, a 5-kilowatt station is being built at Vadso on the borders of the Varanger Fjord, one of the northernmost points of the country. As in view of distance from Oslo, a suitable landline would prove an expensive item, the national broadcasts will be relayed to Vadso through the medium of a short-wave transmitter.

Experiments on these lines are being carried out at Jeloy, on the Oslo Fjord, on 42.92 metres (6,990 kilocycles), but the wavelength is still a temporary one. The power used would appear to be about 500 watts, and this relay of the Oslo programmes is very well received in the British Isles.

The channel allotted to Norway for Vadso is 845 metres (355 kilocycles) and must be shared with a 20-kilowatt transmitter already installed at Rostov-Don (U.S.S.R.).

◆ ◆ ◆

POLAND

Notwithstanding the fact that Poland possesses in the neighbourhood of Warsaw one of the most powerful stations in Europe, in many parts of the country simple crystal sets are still used, and do not permit their listeners to hear entertainments from the capital.

For this reason, the network of relays is to be extended by additional stations at either Torun (Thorn) on the Vistula, about eighty-five miles due south of Danzig, or Gydnia, on the borders of the Baltic, and at Pinsk. The Torun station will be synchronised to work with Cracow on 219.6 metres.

Poznan, as one of the most important centres, will see the power of its station increased before the end of the year to 20 or 25 kilowatts. The question of selection in regard to Torun or Gydnia will depend on immediate events; the choice will rest on the most favourable site for reception in Danzig, as the transmitter would be largely used for broadcasts to serve as an antidote to the anti-Polish propaganda regularly put out by the Köenigsberg and Heilsberg studios.

To give more adequate service to Eastern Poland (on the Russian frontier), a further relay of the Warsaw programmes will be installed at Pinsk.

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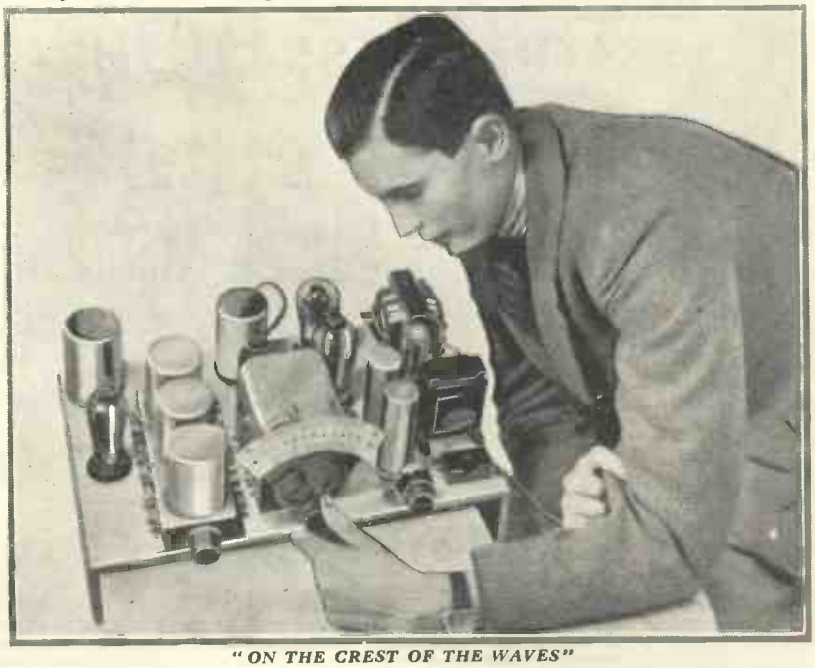
YUGOSLAVIAN RADIO NET

A COMPLETE reorganisation of the Yugoslavian broadcasting system is to take place during 1934. Work is to be started immediately on the new Belgrade transmitter, which is to replace the present 25-kilowatt station. The site chosen for this 56-kilowatter is Makis, in the immediate neighbourhood of the capital. Studios already exist in the buildings of the Academy of Sciences at Belgrade.

Simultaneously, relay stations will be erected at Skoplje (formerly Uskub), the old capital of Southern Serbia, for Macedonia; at Subotica (Szabadka), or at Zombor in the Voivodin district, and at Sarajevo, the former capital of Bosnia, under Austrian rule. Zagreb (Agram) will be given a new transmitter (15 kilowatts) and when this is installed the plant may be transferred to Spljet (Spalato), a small port on the Adriatic. So far, no alterations are to be made at Ljubljana.

If a change over of wavelengths takes place on January 15, the Yugoslavian stations will work on the following channels : Belgrade, 437.3 metres (686 kilocycles); Ljubljana, 569.3 metres (527 kilocycles); Zagreb, 276.2 metres (1,086 kilocycles); and a channel has already been allotted in the Plan de Lucerne to Skoplje, 476.9 metres (629 kilocycles). Other relays would be compelled to work on the International common wavelength of 209.9 metres (1,429 kilocycles), and an exclusive channel in the lower part of the band, namely, 241.9 metres (1,240 kilocycles).



"ON THE CREST OF THE WAVES"

An ether hunt being carried out with the new super-het described on pages 474-479 of this issue—the very latest in station-getters

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PERMAREC

PERMAREC is one of the new things in radio. There have been many attempts to produce a permanent flexible home recording record for use on a standard radiogram, but these have generally failed to achieve their object.

Now Musikon, Ltd., who for the past year have been designing sound recording and reproduction apparatus have brought out the new Permarec flexible unbreakable home recording permanent record.

Of course there are all sorts of jobs you can do with a record like this, which is up to the usual commercial standard and owners of home ciné equipment, for instance, will, for the first time, be able to make really practical recording of sound during the taking of 16 or 9.5 m.m. film.

" Permarec " is the title of a very useful booklet which has just been sent me by Musikon, Ltd., of 17 Lisle Street, London, W.C.2, and if you are interested in practical home recording I advise you to get a copy. **356**

◆ ◆ ◆

FITTING AN EXTENSION

YOU can fit an extension loudspeaker to practically any set. In fact it is true to say that every good set deserves an extension speaker because the enjoyment of radio entertainment is doubled when it is possible to listen in any room in the house without moving the set. **357**

If you are puzzled to know how to do it, then get the new Wharfedale leaflet, for the Wharfedale moving-coil speaker people have just brought out an extension loud speaker.

This loud speaker has a combined on-off switch and volume control built into the cabinet. Result, the volume can be adjusted exactly to suit the room, or unwanted items can be cut off from the extension speaker or left at very low volume, until the desired change in the programme arrives. The fact that the switch and control are fitted in the speaker cabinet means that you have no detailed wiring to do.

These Wharfedale speakers are made in six types. For details see the new leaflet. **358**

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A GOOD BATTERY LIST

THERE'S a really comprehensive battery type list from Ever Ready. It unfolds to disclose a complete list of popular commercial receivers, together with the recommended type numbers of high tension, low tension, and grid bias batteries. This is a useful sheet for the enthusiastic radio fan who is in touch with a number of receivers and wants to know replacement battery type numbers without a lot of catalogue hunting. On the other side of this useful chart are given the dimensions, tapping ranges, list numbers, and prices of all the batteries referred to. **359**

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MIDGLEY MOVING COILS

I HAVE been greatly interested in Midgley speakers since Mr. A. H. Midgley, M.I.E.E. first introduced his novel idea. Now I see that the new company who manufacture these special moving-coil jobs is Midgley Harmer, Ltd., of Dukes Road, Western Avenue, London, W.3, and an interesting booklet has been brought out, showing the domestic types.

Let me remind you that in the Midgley speaker the diaphragm consists of a thin aluminium sheet held between inertia rings. The diaphragm assembly is held in a chromium-plated steel chassis and grille. Midgley speakers are thus of all-metal construction and particularly good response in the middle register is claimed with a good balance between treble and bass. It is also claimed that this type of speaker is more sensitive than the usual cone. The prices are very reasonable. **360**

◆ ◆ ◆

A UNIVERSAL CONTROLLER

THIS will appeal to the man who has serious testing work to carry out. The Universal controller is a multi-range tester which works on alternating or direct current supplies and is provided with shunts so that it can be used for practically every radio testing job.

In the main, the movement consists of a moving-coil pointer arrangement and a Westinghouse type rectifier enables the tester to be used on alternating current supplies.

The tester is manufactured by Messrs. Chauvin & Arnoux, of Paris, but is being handled in this country by Mr. Benoit, who has sent me an interesting folder in English, describing this tester and its capabilities. **361**

◆ ◆ ◆

THE LIGHTNING DANGER AGAIN

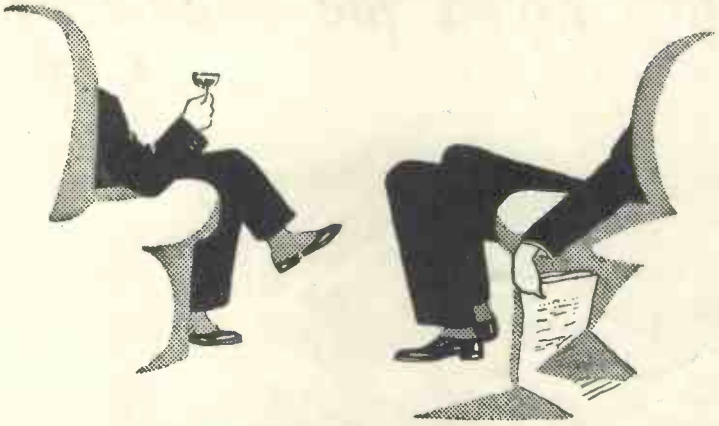
PLEASE don't imagine that you need worry about the lightning danger only in the summer months.

The real lightning " bogey " has been killed I hope, and most technical folk realise by now that while a direct lightning hit on a set is very rare, it is at all times desirable to protect an outdoor aerial system with an efficient lightning switch to dissipate static charges.

The Vernon Lockwood Manufacturing Co., Ltd., have brought out the Verloc safety lightning switch which has a number of novel features and is covered by the guarantee that the switch will be replaced free if damaged by lightning.

When you are overhauling your aerial, consider fitting a switch of this description. It may be a valuable safeguard.

"Can you suggest a 'surprise item' for Christmas, old man?"



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Name.....

Address.....

W. MAG. 12/33

(3986

CHRISTMAS RADIO GHOSTS!

by DEREK ENGLAND

Ultra-short-wave transmissions may be reflected by the moon's surface, a portion of which is shown by this fine astronomical photograph taken at the Mount Wilson Observatory

CHRISTMAS GHOSTS are on the way!

In spite of twentieth-century apathy towards psychic happenings, there are innumerable proofs that spirit manifestations do take place at certain times of the year and that there is at least a foundation of truth for the ghost stories beloved of our grandparents.

Modern science is not only proving that our ghost stories are true, but that owners of haunted houses throughout the country are not worried without cause at Christmas time. Scientific investigation is showing that in many cases electrical and radio phenomena are responsible for Christmas ghosts.

In the files of the National Laboratory of Psychical Research in Kensington are documents which may prove that the occurrence of spirit manifestations is due perhaps not only to the actual workings of an existing spirit but to what (for the lack of a better word) we must call an "echo" of past happenings.

The theory is being rapidly developed that the brain operates by an electro-chemical process and that any intense thought action may result in a corresponding electro-chemical, electro-magnetic or even radio-electric action which can be detected by electrical and mechanical means.

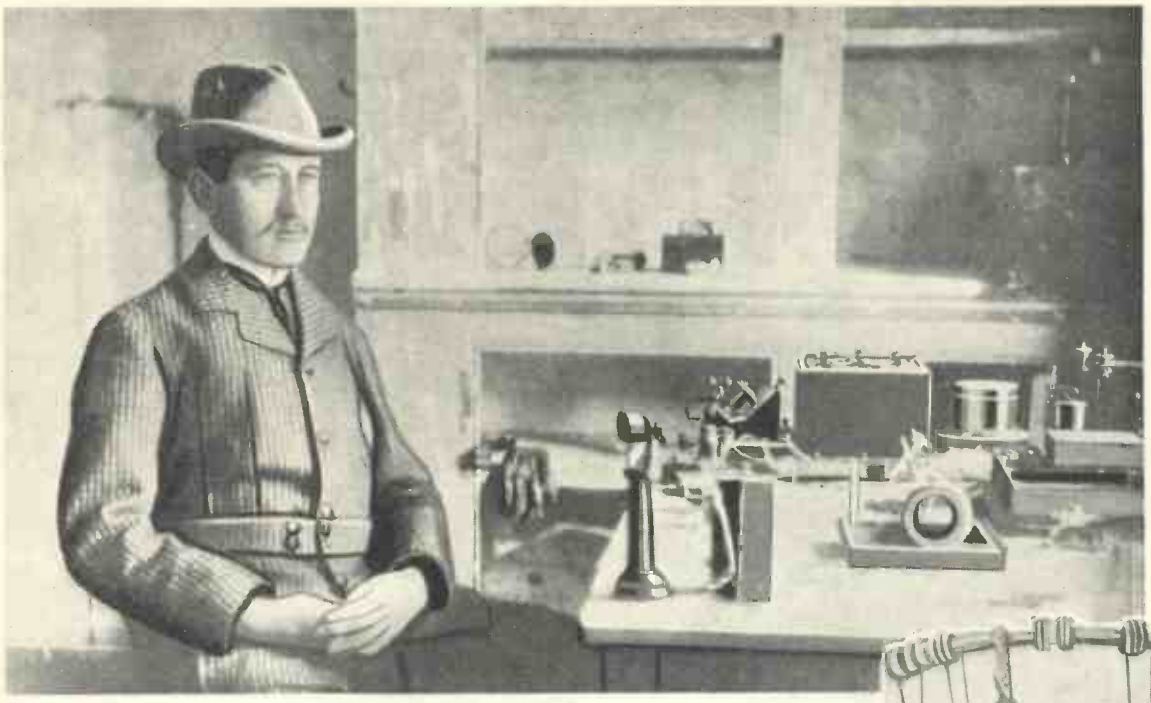
In America and in the French Surété electrical means are already employed to discover whether a suspect is telling the truth. The nervous reaction of the whole body when the mind has to concentrate on a definite untruth is registered by a change of nervous tension and a resulting increase or decrease in the natural static charge of the human body.

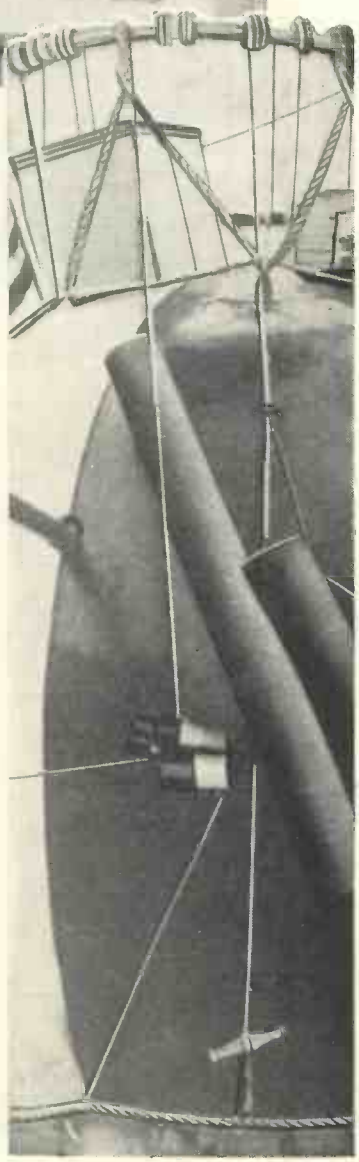
What is known as the Broca's area of the brain is responsible for nerves controlling speech. If the whole human system is considerably excited then it is possible that the electrical disturbances created by the nervous action of the Broca's area of the brain cell structure can be detected electrically.

If these electrical disturbances are capable of detection by means already known to scientists for

A STRATASPHERE EXPLORER

This photograph of Professor Piccard was taken immediately after his recent attempt to explore the stratasphere, more than ten miles up from the earth's surface. It is believed that the ionised surface here reflects electrical waves





"GHOST" WIRELESS SIGNALS

The above photograph, published for the first time in a wireless periodical, is of the Marchese Marconi in the room at Signal Hill, Newfoundland, where he received the first Transatlantic signals on December 12, 1901. The right-hand photograph is of Professor Piccard entering the gondola of his balloon on a recent attempt to explore the upper ionised layer

the observation of minute electrostatic and electro-magnetic impulses, then the first step in the radio ghost theory has been established.

The next step is to prove that these electrical disturbances, once created, echo for considerable periods of time and are capable of redetection at some period after their creation. If this is possible then it means that, say, an exciting event in history, involving considerable mental strain and thought energy, may be capable of re-appreciation at some definite time cycle after the event.

Here we must turn to radio phenomena of the more ordinary type.

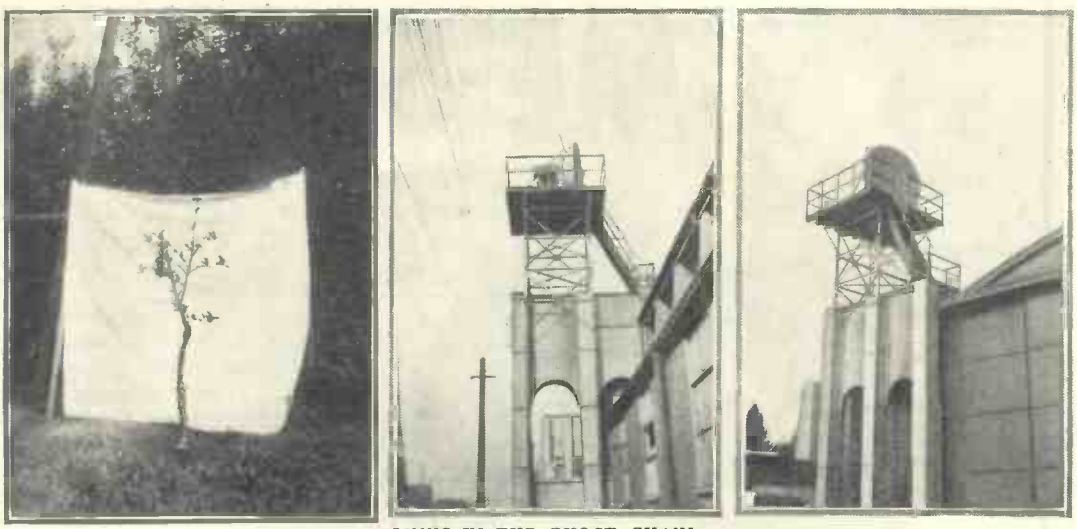
Wireless waves have a definite echo and do not die away immediately after the ether disturbance is created. Echo effects are visible on television receivers as a slight halo on one side of the image. In long distance commercial radio working the echoes of wireless waves travelling several times round the earth's surface are extremely troublesome. Ordinary electrical echoes on long cables have to be filtered out. The existence of an echo effect of ether waves in a certain frequency range is beyond dispute.

We assume that ordinary radio wavelengths echo by means of constant reflection between the upper Heaviside layer and the earth's surface. The ionisphere so successfully investigated by Prof. Piccard going to ten miles above the earth's surface is probably one of the reflecting shells, opaque to wireless waves in a certain section of the frequency spectrum.

As a result of tests with microwave apparatus on the almost optical wavelength of 17.5 centimetres, it has been found that there is no appreciable reflection of these waves by the Heaviside layer. A transmitter circuit using this very short wavelength is now testing between the Lympne aerodrome and St. Inglevert, 40 miles away in France. These radiations can be focused with practically no spread by parabolic reflectors 10 ft. in diameter. If these short wavelengths are not reflected by the ionisphere then they may penetrate out into the universe and by careful focusing they may be reflected by other bodies in the planetary system or even by the surface of the moon.

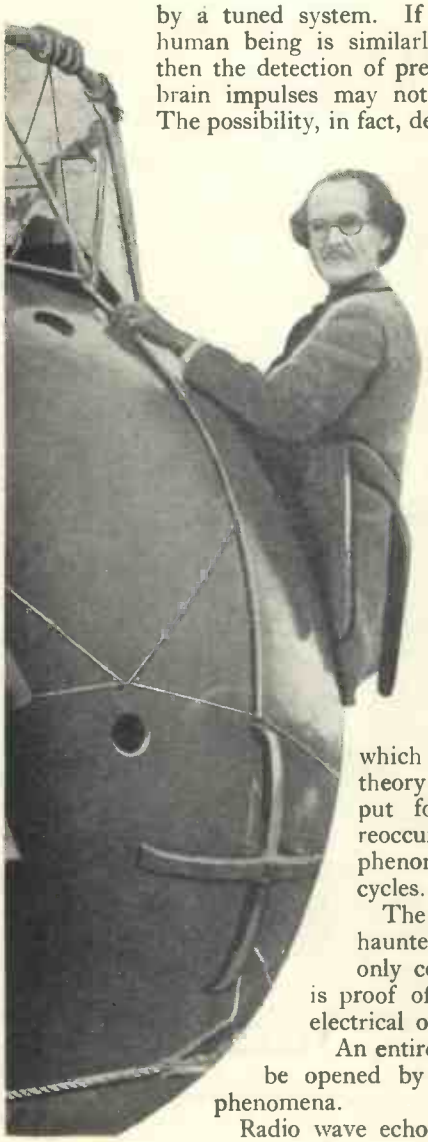
If the electrical disturbances of the brain are anything akin to those ultra short wave radiations then a considerable time may elapse between their creation and their reflection from some body in the universe.

Wireless wave echoes are infinitely weaker than the initial vibrations but are nevertheless capable of detection



LINKS IN THE GHOST CHAIN

The left-hand photograph is of a ten-year-old apple tree planted in a German rural area affected by earth rays and locally believed to be bewitched. The centre and right-hand photographs are of the ultra-short-wave transmitter at Lympne. The beam from this transmitter is believed to penetrate the Heaviside layer



by a tuned system. If the brain system of a human being is similarly tuned to past events then the detection of previously created electrical brain impulses may not be a difficult matter. The possibility, in fact, depends upon the strength of the initial thought radiations, the distance over which reflection takes place, the sensitivity of response of the subject and the exact coincidence of the time cycle.

If a sensitive subject —not necessarily a spiritualist medium—is present at a scene of great mental stress at a definite time cycle after the initial creation of the thought electrical disturbance, then the whole scene may be re-enacted. This at least is the theory on which certain psychical investigators are now working and which is at least the first sound theory with a scientific backing put forward to explain the reoccurrence of "ghost phenomena" at definite time cycles.

The appearance of ghosts in haunted houses for example at only certain times of the year is proof of an echo effect, either electrical or spiritual.

An entirely new radio field may be opened by investigation into this phenomena.

Radio wave echoes are so common that there is every reason to believe the existence of echoes of waves in other parts of the spectrum.

When the short-wave beam stations were opened, using directional beam aerials focusing a radio wave beam over the surface of the earth it was found that at first the signals were hopelessly jumbled. This puzzled the engineers until they found that a reduction of power cleared the trouble. With high power the signals continued to echo round the word and produced a jumbled result a any one receiving point. When the power was cut down the echoes were so weak that the signal were not normally receivable.

Curious groups of three staccato signals are frequently received on long-wave receivers and static interference is considered the cause. But many experimenters believe that the initial man-made ether disturbance set up by Marconi's three "S" signals on the eventful December 12, 1901, is still echoing.

Obviously the diminution of strength of wireless waves after one earth circuit means that very sensitive apparatus is necessary to detect them. But if we are considering the detection of minute electrical vibrations set up by thought energy, then we may find that the sensitive human brain is quite capable of detecting the echoes of these waves.

There are many other aspects of the radio ghost question. In country districts, for instance, blighted trees and barren areas are frequently cited as an example of ghost haunting and this is a matter which in many cases scientific investigation has proved to be due to an electrical effect. Baron von Pohl in investigating earth rays has been convinced that these are responsible for the lack of germination in certain ground areas. In other words, the "ghost" phenomena has been explained by definite electrical scientific means.

The MERRYMAKER

In these pages we present full constructional efficient four-valve A.C. super-het. It has been WILKINS and is here described by the "Wire-

HERE are details of a set that is a real winner! An ideal set for the family—a set that will satisfy the most exacting searcher for foreign stations and that is so simple to operate that a child can handle it after a few minutes instruction.

That, in brief, is why you should build this outstanding four-valve mains super-het. We have called it the Merrymaker Super because it will bring enjoyment to everybody in every home where it is used.

Fine Station Log

As you will see from a glance at the test report on pages 479 to 480 of this issue, well over fifty stations were picked up on the loud-speaker during a test carried out quite independently at the request of the "Wireless Magazine" Technical Staff. That will be sufficient proof for most people that the set really does work efficiently.

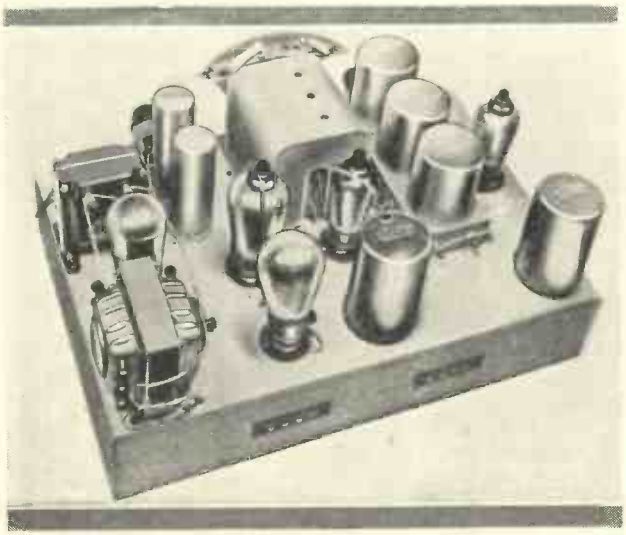
The fact that it is simple to operate is obvious from a glance at the photographs of the set that appear in these pages. There is only one tuning control, while on the left of this is a combined wave-change and gramo-radio switch, with a combined volume control and on-off switch on the right.

As the set is only a four-valver, readers will be interested in the valve sequence. In the first place comes the combined detector-oscillator, then the intermediate-frequency amplifier, the second detector and a final output valve. It should be noted that no metal rectifier is used at any point of the set, so the circuit really is a four-valver super-heterodyne.

Using a Pentagrid

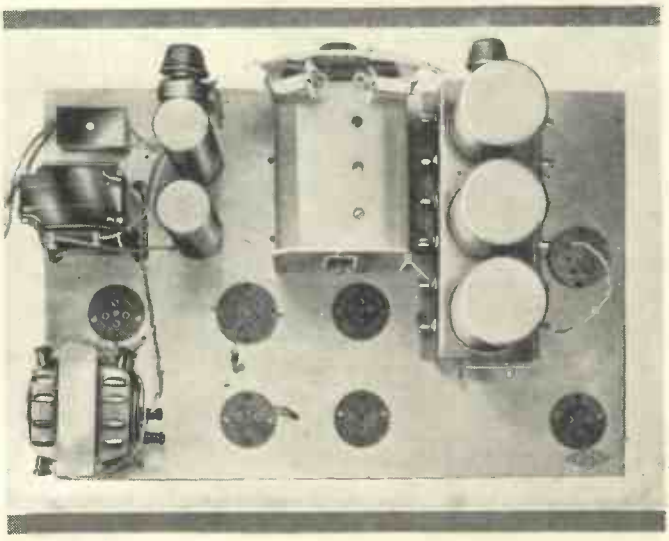
The detector-oscillator is a pentagrid or heptode (the first term means that the valve has five grids, while the second means that it has seven electrodes, which amounts to the same thing, as there is only one anode and one filament). Thus we get two distinct functions in one valve, the oscillator coupling being electronic. This results in approximately constant oscillator injection at all frequencies and provides great stability.

In front of the detector-oscillator there is a band-pass aerial tuner. This is simply to give sufficiently sharp input tuning to avoid second-channel interference, one of the greatest bugbears of a super-het. A better way out of the trouble is to use a pre-detector high-frequency stage, but when one is limited to four



MAINS PORTION ON THE LEFT

On the left can be seen the mains transformer, the rectifying valve, and the smoothing choke. There are also two electrolytic condensers



TOP-OF-CHASSIS VIEW

The clean appearance of the top of the Merrymaker Super chassis is clear from the special plan view reproduced here

SUPER

details for the building of a really

designed by S. RUTHERFORD

less Magazine" Technical Staff

ALL READY TO TRY THE SET OUT—PUTTING THE VALVES INTO POSITION

We are confident that everybody who builds the Merrymaker Super will find that it gives them the best possible reception that can be expected from a circuit of the type employed

valves that course is out of the question. With a good band-pass circuit, which we have been able to incorporate in this design, the trouble is overcome to a very great extent; so much so, in fact, that we do not anticipate any criticisms of the set on this score, at any rate.

Band-pass input and the necessity of tuning the oscillator coil means that three condensers are needed. The problem that we are then faced with is whether to use a three-gang condenser, a two-gang and a single condenser, or three single condensers. The last course can be wiped out at once, for very few people would nowadays have the patience to tune three separate dials every time they wanted a change of programme.

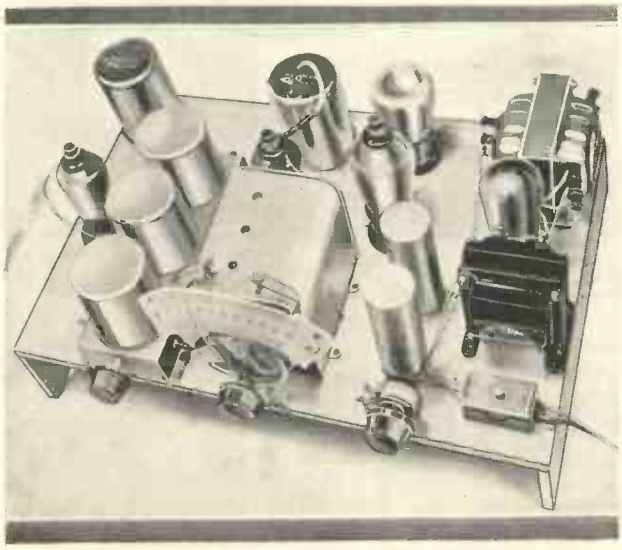
One-knob Control

We are then left with the alternative of using a three-gang model, which will definitely give one-knob control, or a combination of two-gang and a single condenser. We have adopted the former method for three reasons. In the first place, it makes the layout of the set very much more attractive; secondly, it enables any member of the family to operate the receiver without the slightest difficulty; and thirdly, so powerful is the four-valve combination that the slight extra efficiency that would be obtained with the two-gang and single condenser combination is not needed.

It should further be noted that the condenser is of the standard type and has no specially shaped vanes to track up with any particular make of oscillator coil. Tracking condensers are needed, but they are provided inside the coils themselves. There is a small trimmer on each coil base to give the necessary alinement on the long waves.

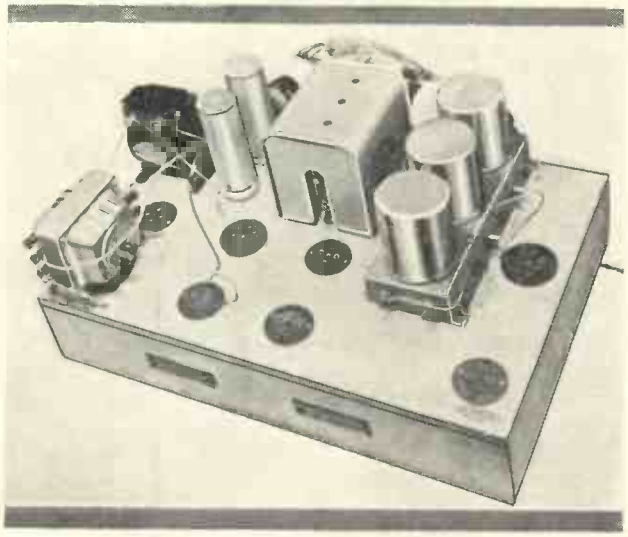
Enormous Amplification

The second valve in the set, which is, of course, the intermediate-frequency amplifier, is one of the new variable-mu high-frequency pentodes and gives enormous amplification with perfect control of volume. Old hands should note that in this set they can use intermediate



SIMPLE CONTROLS BUT AMAZING RESULTS

Although there are only three controls on the set its efficiency is very great, as will be appreciated from the test report that appears on pages 479 and 480



THE SET WITHOUT ITS VALVES

The positions of the holders for the four valves (the rectifier makes a fifth, of course) and the intermediate-frequency coils are seen in this photograph

coils of the type originally employed for the Super 60 and other sets of the same family. The intermediate frequency is 26 kilocycles; two coils are needed, one with a pigtail connection and the other without.

Duo-diode-Pentode

The second detector is a duo-diode-pentode and combines three functions—high quality diode detection, automatic volume control, and separate low-frequency amplification. It might be thought that with only one intermediate stage no automatic control of any use could be obtained; that, in general, is an assumption that would be justified, but in this case the pentode portion of the duo-diode-pentode is also of the variable-mu type—therefore, low-frequency control is obtained on this as well as the high-frequency control.

Between the second detector and the power valve is a parallel-fed auto-transformer for good quality reproduction. This is coupled direct to the 2.5-watt output pentode, which will give enough volume to satisfy the most ambitious—unless they live in a house like the Crystal Palace!

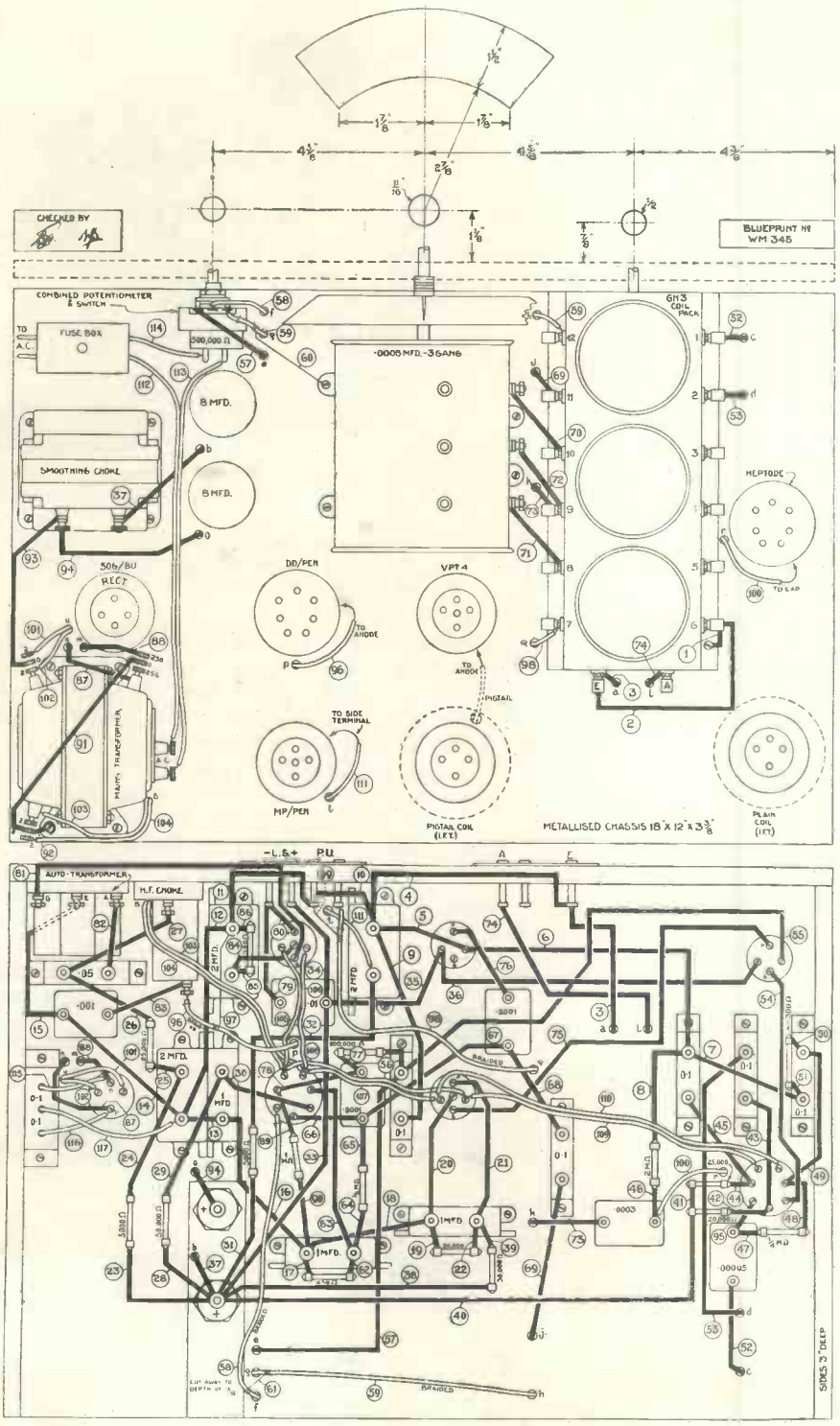
Talking about quality, it should be noted that there is an intermediate-frequency filter between the duo-diode-pentode and the output pentode to stop high-frequency currents from leaking through into the low-frequency stages.

Top-hole Design

From these points it will be seen that trouble has been taken throughout the design of the set to give the greatest possible efficiency. That this object has been achieved will be quite clear from the special test report that appears on pages 479 and 480 of this issue.

Apart from purely theoretical considerations, however, the Merrymaker Super will attract many constructors on the score of its appearance. In these pages we show the set in its radio-gramophone cabinet; it makes a handsome outfit that will grace any home in which it is installed.

It will be noted that the efficient and simple baseboard-chassis



QUARTER-SCALE LAYOUT AND WIRING DIAGRAM

If desired, a full-size blueprint can be obtained for half price, that is 9d., post paid, if the coupon on the past page is used by December 31. Ask for No. WM345 when ordering. Note that all the connections are numbered in the best and most convenient order of assembly; mark the numbers through as the wires are put into position. Note how the baseboard is cut away to a depth of $\frac{3}{16}$ in. to facilitate mounting the electrolytic condensers

method of construction has been adopted. In other words, the baseboard, which is covered with a coating of metal, is arranged on runners; this has the effect of turning the baseboard into a simple form of chassis. As the metal is only sprayed on to the wood, it is very easily worked with the ordinary wood tools. Although this form of chassis is very simple for the constructor to handle, it has all the electrical advantages normally associated with a complete sheet-metal chassis.

Full-size Print

Although all the details essential for the building of the Merrymaker Super are included in these pages, we realise that many readers will prefer to work from a full-size blueprint. One of these can be obtained for half-price (that is, 9d., post paid), if the coupon on the last page of the issue is used before December 31. Address your application to "Wireless Magazine," Blueprint Dept., 58-61 Fetter Lane, London, E.C.4; and ask for No. WM345.

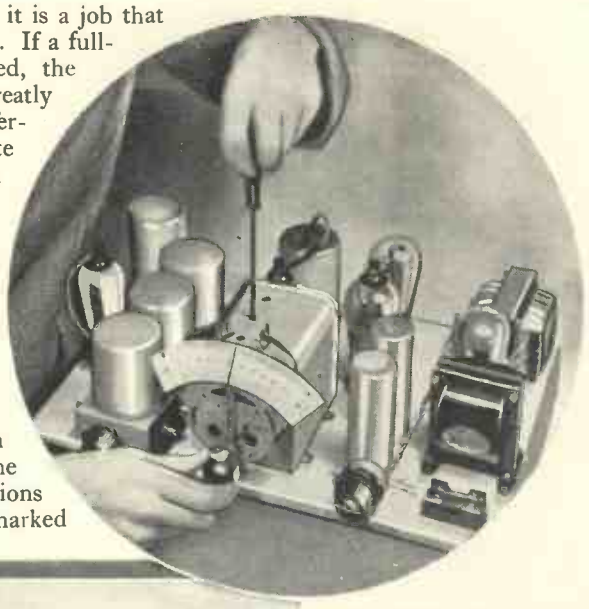
The actual laying out of the set will not be found at all difficult, although it is a job that should not be rushed. If a full-size blueprint is used, the operation will be greatly simplified; but nevertheless, it is quite possible to work from the quarter-scale reproduction on the facing page.

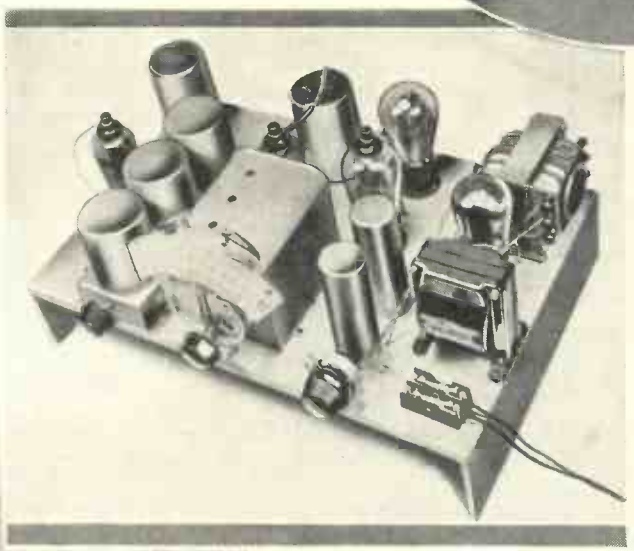
It will be seen that the blueprint shows the positions of all the holes needed in the chassis for passing the wires through from the top to the underside. The positions of these should be marked through from the blueprint, which is spread out on top of the chassis, by means of some sharp-pointed instrument. At the same time the positions of the fixing screws for the components mounted on the top of the chassis should also be marked through.

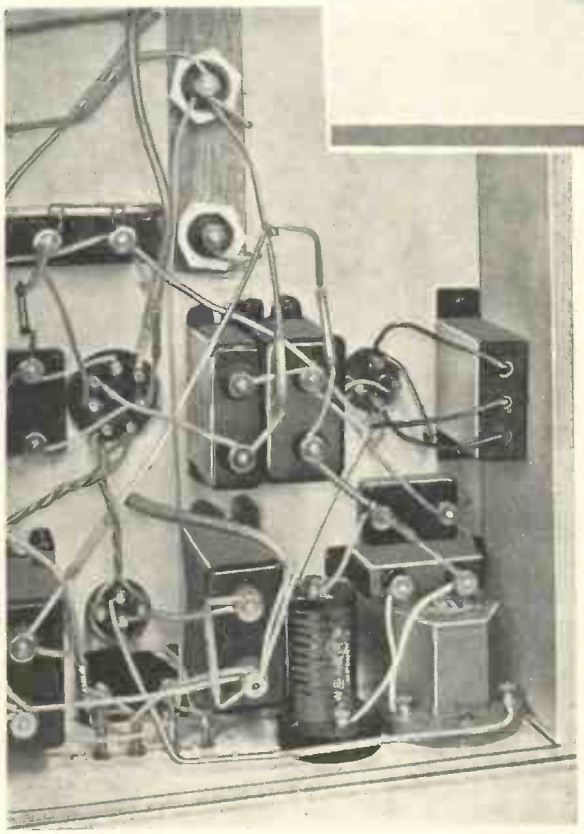
The same operation applies to the underside of the chassis, but in this case only the component-fixing screws need be marked out, as the holes for the connecting wires will have been marked out on top already.

Only those holes needed for passing connections through from one side to the other should be drilled. The other markings are only needed as a guide to the proper positioning of the components.

It should be noted at this point that the layout should be closely followed. To get good results from four valves it is obvious that every stage must be working at its maximum efficiency. This has only been made possible by a great amount of experimental work, from which it was found that the placing of certain components had a considerable effect.





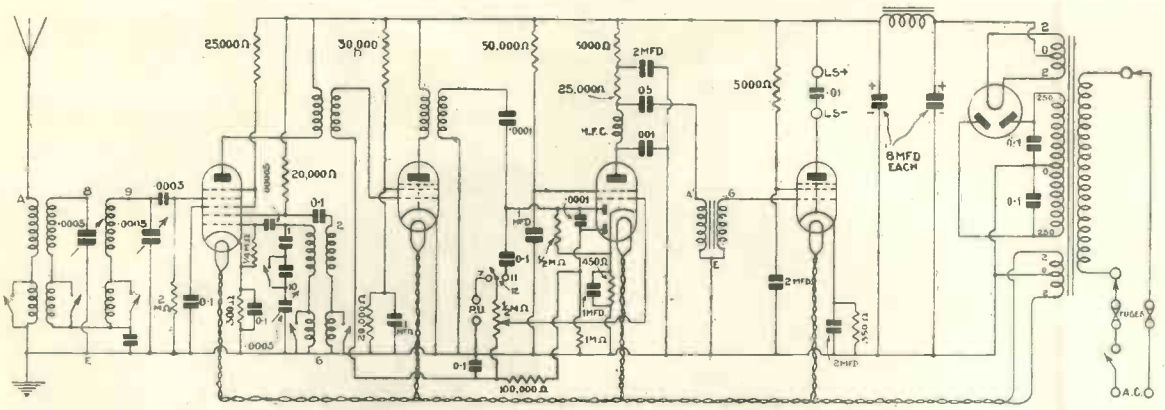


THREE MORE VIEWS OF AN OUTSTANDING DESIGN

At the top is a view of the set being ganged up. Above is a top-of-chassis view in which the mains fuse can be clearly seen in the top right-hand corner. On the left is an underneath view of the chassis showing how two of the parts are mounted on the side

Component Positions

For instance, it will be seen that the auto transformer used for the low-frequency coupling and the intermediate-frequency filter choke are mounted on the side of the chassis. In other words, the axis of these windings is at right angles to the axis of the mains transformer windings and pick-up between the three components is reduced to a minimum. If this layout is not followed, it is likely that mains hum will be



CIRCUIT THAT BRISTLES WITH NEW FEATURES

The circuit of the Merrymaker Super bristles with new features that put it in a class by itself. Note that some of the condensers shown are included in the coil assemblies

experienced. With the components placed as shown, this trouble is definitely avoided.

As soon as all the parts have been fixed in position, the wiring of the set can be started. It will be seen that each wire is numbered separately; these numbers indicate the best and most convenient order of making the connections. Start off with wire No. 1 and then proceed in the proper numerical order indicated by the figures in circles.

In those cases where a wire goes through from the top of the chassis to the underside the hole to accommodate it is marked with a small letter; these letters appear on both parts of the blueprint, so that there is no difficulty about checking.

It is a good plan to mark through each number on the blueprint with a pencil as the corresponding connections are completed. In this way it will be impossible to make a mistake.

As soon as the set has been completely wired, it can, of course, be put into operation and tried out on an aerial. Care should be taken to see that the valves are placed in their proper holders, otherwise there will be trouble.

Ganging of the set is carried out in the usual way and there is no need for us to go into great detail here. Anybody who has any doubts on this point should read the article, "Lining Up the Gang," that appears elsewhere in this issue.

Those who live in London and would like to see the original model of the set will find it in Selfridge's Somerset Street windows throughout the currency of this issue.

COMPONENTS YOU WILL NEED TO BUILD THE MERRYMAKER

	£	s.	d.
CHASSIS			
1—Peto-Scott Metaplex, to specification	0	4	6
CHOKE, HIGH-FREQUENCY			
1—Wearite type HFS (or Bulgin, Goltone)	0	4	6
CHOKE, LOW-FREQUENCY			
1—Ferranti, type B1 (or Heayberd, Parmeko)	1	1	0
COILS			
1—Wearite set of three mounted on one base, type GN3	1	10	0
CONDENSERS, FIXED			
1—T.C.C. .00005-microfarad, type S (or Dubilier, Telsen)	0	1	3
2—T.C.C. .0001-microfarad, type S (or Dubilier, Telsen)	0	3	9
1—T.C.C. .0003-microfarad, type S (or Dubilier, Telsen)	0	1	3
1—T.C.C. .001-microfarad, type S (or Dubilier, Telsen)	0	1	6
1—T.C.C. .01-microfarad, type S (or Dubilier, Telsen)	0	2	6
1—T.C.C. .05-microfarad, type 40 (or Dubilier, Telsen)	0	1	9
5—T.C.C. .1-microfarad, type 50 (or Dubilier, Telsen)	0	9	2
3—T.C.C. 1-microfarad, type 50 (or Dubilier, Telsen)	0	5	8
3—T.C.C. 2-microfarad, type 50 (or Dubilier, Telsen)	0	7	8
1—Dubilier .2-microfarad centre-tapped, type BE31L (or Peak, T.C.C.)	0	3	0
2—Dubilier 8-microfarad electrolytic (or Peak, Telsen)	0	11	0
CONDENSERS, VARIABLE			
1—Polar three-gang .0005-microfarad, type Star Minor, with arcuate drive	1	4	6
HOLDERS, VALVE			
3—Clix four-pin chassis mounting	0	2	0
2—Clix five-pin chassis mounting	0	1	6
2—Clix seven-pin chassis mounting	0	2	0
HOLDERS, FUSE			
1—Bulgin twin, complete with fuses type F14 (or Belling Lee)	0	2	3
RESISTANCES, FIXED			
1—300-ohm Siemens, type SS, ½-watt	0	0	7
1—350-ohm Siemens, type SS, ½-watt	0	0	7
1—450-ohm Siemens, type SS, ½-watt	0	0	7
2—5,000-ohm Siemens, type SS, ½-watt	0	0	7
2—20,000-ohm Siemens, type SS, ½-watt	0	0	7
2—25,000-ohm Siemens, type SS, ½-watt	0	0	7
1—30,000-ohm Siemens, type SS, ½-watt	0	0	7
1—50,000-ohm Siemens, type SS, ½-watt	0	0	7
1—100,000-ohm Siemens, type SS, ½-watt	0	0	7
1—¼-megohm Siemens, type SS, ½-watt	0	0	7
1—½-megohm Siemens, type SS, ½-watt	0	0	7
1—1-megohm Siemens, type SS, ½-watt	0	0	7
1—2-megohm Siemens, type SS, ½-watt	0	0	7
RESISTANCES, VARIABLE			
1—Claude Lyons ½-megohm with two-point switch, type P5/500A/S	0	8	6
SUNDRIES			
1—B.R.G. 2-in. metal mounting bracket	0	0	6
Round tinned copper wire, No. 20 gauge, for connecting (Lewcos), say	0	0	9
Oiled sleeving (Lewcos), say	0	1	6
3 ft. shielded sleeving (Lewcos), say	0	0	6
4 yd. thin flex (Lewcoflex), say	0	0	4
2—Bulgin knobs, type K14	0	0	9
1—Bulgin knob, type K12	0	0	6
TERMINALS, ETC.			
1—Clix strip, marked: A1, A2, E	0	0	7
1—Clix strips, marked: Pick-up, L.S.+, L.S.—	0	0	8
TRANSFORMERS, INTERMEDIATE-FREQUENCY			
1—Wearite, type OT1	0	10	6
1—Wearite, type OT2	0	10	6
TRANSFORMER, LOW-FREQUENCY			
1—R.I. Auto-Parafeed, type DY45	0	6	9
TRANSFORMER, MAINS			
1—Wearite, type T21A	1	5	0
VALVES			
1—Ferranti Heptode, VHT4	1	0	0
1—Ferranti VPT4	0	17	6
1—Cossor DD/Pen	1	0	0
1—Cossor MP/Pen	0	18	6
1—Cossor 506BU	0	12	6

ACCESSORIES

	£	s.	d.
CABINET			
1—Osborn 259	3	10	0
GRAMOPHONE MOTOR			
1—Garrard A.C., type 202A	2	10	0
LOUD-SPEAKER			
1—Magnavox Permanent Magnet Senior, type 252	3	3	0
NEEDLE CUP			
1—Bulgin Duplex	0	2	6
PICK-UP			
1—B.T.H. De Luxe	1	17	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 Evening with the Merrymaker

A frank report—done quite independently of the "W.M." Technical Staff—on the performance of the Merrymaker Super by EDWARD J. TUNNICLIFFE, Assoc. I.R.E. Excellent results were obtained on a poor aerial as described in the personal account below

I AM very particular where radio receivers are concerned. When I was asked to put the Merrymaker through its paces, therefore, I decided to allow no quarter. A first-class aerial system could have been used, but it was decided to rig up an indifferent one to check the receiver's behaviour. This consisted of 50 ft. of wire 12 ft. high.

Stations Without Effort

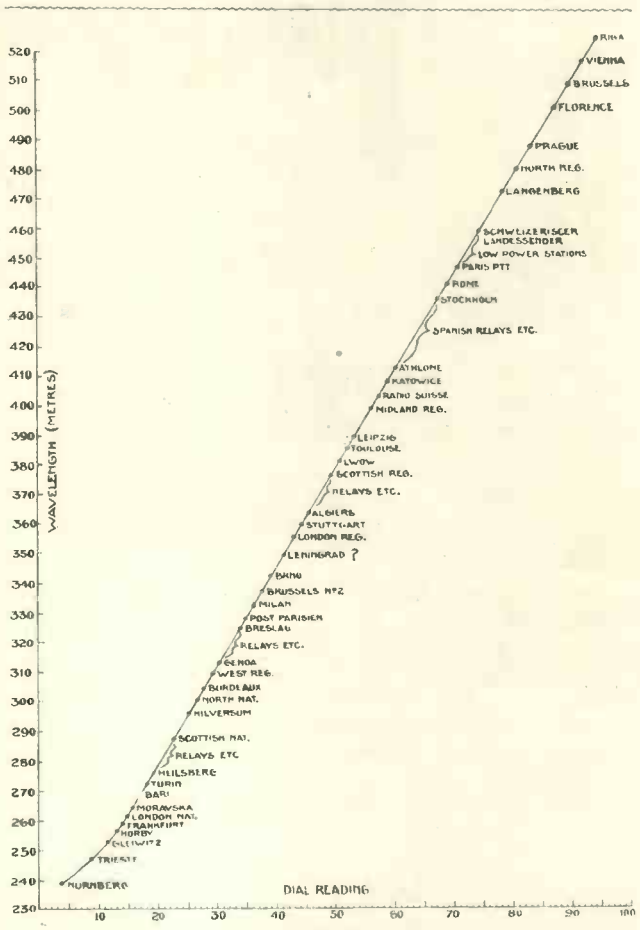
Within five minutes of handling the one tuning control I was convinced that the whole dial was alive. Without any "tuning effort" I then proceeded to run round the dial. The result was a list of fifty-eight stations, which is given in these pages.

The receiver has a sufficiently silent background to offer good scope to the listener who enjoys concluding an evening's entertainment with a run round Europe. By this I mean that weak carriers may be developed into signals which are not swamped by background noises—a fault of many super-heterodynes.

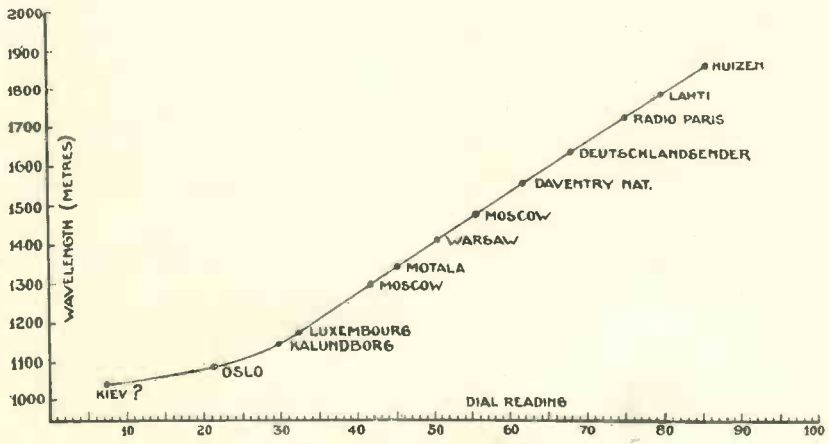
In compiling the list of stations received, it is to be noted that, with the exception of a few weak heterodynes, reception was free from interference and was of remarkably good quality. I was particularly impressed with the good balance of selectivity and high frequency or high-note reproduction.

Quality Not Sacrificed

This set definitely does not sacrifice quality for selectivity. This appears to be partly due to the fact that a critical signal-voltage input to the first valve exists. The result is practically uniform loudspeaker strength for stations worth hearing—due to the A.V.C. valve and the elimination or suppression



MEDIUM-WAVE TUNING CURVE
This shows clearly how selective is the Merrymaker Super

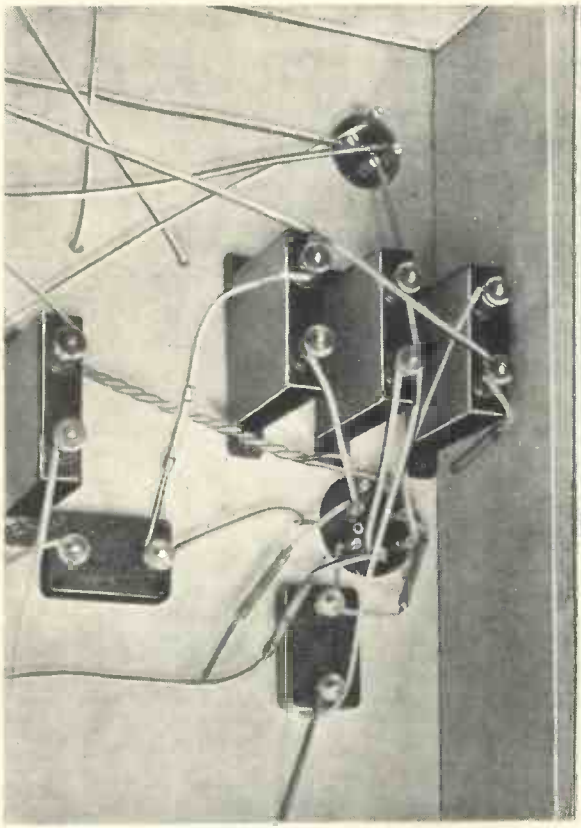


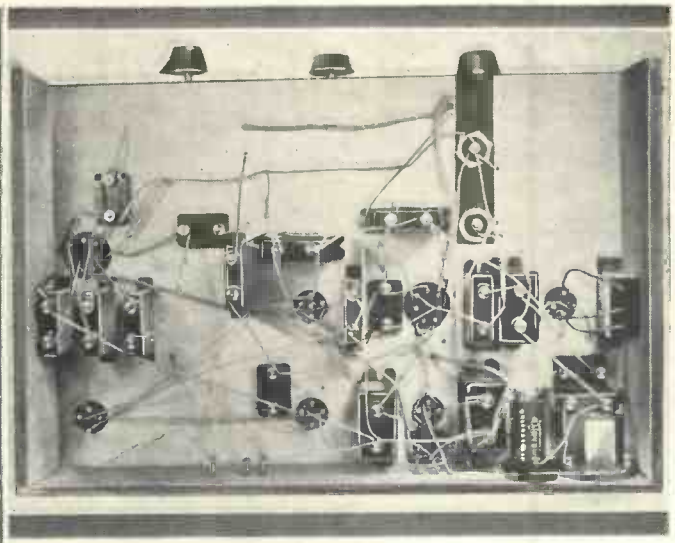
LONG-WAVE TUNING CURVE
Another curve showing the results obtained on the long waves

of relay and weaker stations on neighbouring wavelengths.

Second-channel reception is also non-existant on both wave ranges—a very good feature indeed.

The volume control provides ample and distortionless control on all stations. I might mention here that, having tuned in a station, I reduced the volume to a level considered to be comfortable. This proved that the control may be set at about one-third on for all normal requirements with foreign stations and about one-sixth on for the London transmitters. Considering the form of aerial used, this spoke volumes for the amplifica-





TWO SUB-CHASSIS VIEWS

These two sub-chassis views of the Merrymaker Super show how the wiring is carried out. Construction is not difficult if a full-size blueprint is used

tion efficiency of the circuit arrangement used.

Such stations as Rabat and Algiers, which are of relatively low power, but which are, nevertheless, the source of very interesting programmes, came in clearly and at good volume.

On the long waves, Luxembourg, the new 200-kilowatt station, came through at the same volume as the English transmitters. This station, which was testing, will shortly be entering the already badly crowded field of high-power Continentals to aggravate the conditions calling for such a set as the Merrymaker.

I had anticipated trying this receiver in the small hours with a view to receiving some American stations. Unfortunately, I was unable to do this. However, I see no reason why builders should not add several to their log.

In conclusion, I say unhesitatingly that for a single-dial-tuning receiver the Merrymaker represents the last word.

A glance at the design shows that the building of a first-class receiver is *not* difficult or unduly expensive. The three controls—wave range, tuning, and volume—bring the cream of broadcast programmes to-day to hand. The Merrymaker would, in my opinion, constitute the best source of entertainment for this Christmas.

Log of Stations Received on the Merrymaker

LONG WAVEBAND

Kiev (not definitely identified).
Oslo
Moscow
Kalundborg
Luxembourg
Moscow (Trades Union)
Motala
Warsaw
Moscow (Komintern) not definitely identified)
Daventry National
Deutschlandsender
Radio Paris
Lahti
Huizen

MEDIUM WAVEBAND

Nurnberg
Trieste
Gleiwitz
Horby
Frankfurt
London National
Moravska Ostrava (not definitely identified)
Bari
Turin
Heilsberg
Scottish National
Hilversum
North National
Bordeaux
West Regional
Genoa
Breslau
Poste Parisien
Milan
Brussels No. 2
Brno
London Regional
Stuttgart
Algiers
Scottish Regional
Lwow
Toulouse
Leipzig
Midland Regional
Radio Suisse Romande
Katowice
Athlone
Stockholm (not definitely identified)
Rome
Paris P.T.T.
Schweizerischer Landessender
Langenberg
North Regional
Prague
Florence
Brussels No. 1
Vienna
Riga (not definitely identified)
Wilno

Christmas Bells

By BOB MAJOR

IN a lonely moorside cottage a trembling hand reached towards the wireless set.

"Ten minutes to eight, mother. Time for the bells!"

* * *

High up in the darkened silence of a church tower a man moves among the iron-tongued giants, his lantern casting fantastic shapes over the louvres and walls.

The bells wait, mouth upwards, ready for the service. A glance here, a touch of oil there, and the old man winds his way down the spiral stone steps to the ringing chamber below.

The band of eight take their places at the ropes, hands high on the "sally," faces towards the conductor.

"What's it to be, Tom?" asks one.

"A plain course of Stedman, lads. And let's have it true. Remember, we're broadcasting to-night . . . Ready, boys?—She's gone!"

And with a heave his bell strikes, followed in quick succession by the others— 1 2 3 4 5 6 7 8, 1 2 3 4 5 6 7 8.

"Go, Stedman Triples!"

The bells change over, the smaller ones dodging their way up and down among their large brothers— 2 1 3 5 4 7 6 8, 2 3 4 5 6 7 8*—with the tenor booming its two-ton voice steadily behind.*

In a Canadian cabin, a man dreams into the roaring stove as his radio sends out the echoing notes. A sick man huddled in the cold Judean hills smiles wistfully at the sound of good old English bell-music on the radio.

Far above the streets the notes weave and intermarry in a pattern of sound. Two lovers, walking by the riverside, pause and gaze up at the tower high up in the winter night.

* * *

*Now they are rattling along at a fine pace, even and clear as a gramophone record—*3 6 4 2 7 1 5 8, 3 4 6 7 2 5 1 8 . . . *nearing the end. The heavier bells are closing up in the rear. The treble and its lighter neighbours dance their way to the front—*2 1 3 5 4 7 6 8, 1 2 3 4 5 6 7 8.

"That's all!" cries the conductor.

The microphone fades out the bells and the strains of the organ grow louder.

"A good course, lads, and very well rung! That ought to go out all right."

Out in the street below a man turns to his companion.

"Well, that's one art we have in these islands that is unknown elsewhere—'ringing the changes.'"

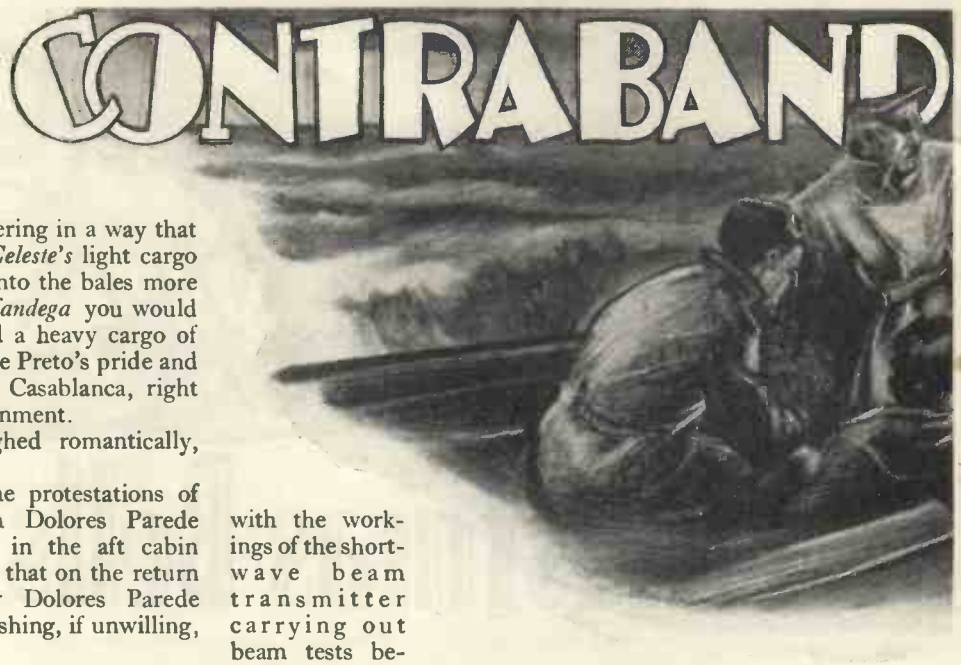
"Aye, John, that beats all they jazz bands!" pipes the dear old lady in her moorside cottage.

Yuletide Medley

I switched off my Wireless to go up to bed,
Then heard a small voice, very squeaky, which said:
"Those bright young Electrons *won't* do 'Watt'
I say,
They shatter my peace into Atoms each day!"
I thought 'twas a Broadcast—and then rubbed my
eyes,
A *Pentode* was speaking, to my great surprise!
"*You* don't Tri-odd's fish! to do things *you* are bid,
And so why should they?" asked a pert little Grid.
"Besides," said an Anode, "young sparks
like to dance,
I'm Positive you would if you had the chance."
"You're Biased against us, and so we Resist!"
Exclaimed an Electron a-shaking his fist.
"You Diode and Double-Diode-Pentode pig!
Your Valves are 'output,' but I don't care a fig!"
With rage the poor Pentode then started to Choke;
The Sets near Howled loudly and—well, I awoke!

L. M. O.

CONTRABAND



JUAN QUIXOTE PRETO sprawled himself out on the deck of the *Celeste* and thanked the fates for his run of luck.

This was his third trip between Lisbon and Saronne, and it looked like being a successful one.

Successful from two points of view.

For one thing, his trade was prospering in a way that was hard to fathom, in view of the *Celeste's* light cargo of maize : but had you investigated into the bales more closely than did the officers of the *alfandega* you would have found that the maize concealed a heavy cargo of ammunition which it was Juan Quixote Preto's pride and profit to run into Saronne, just off Casablanca, right under the nose of the French Government.

For another thing . . . Juan sighed romantically, as he twirled a rope end.

On this third trip, in spite of the protestations of Maria, he had brought with him Dolores Parede Castanho : and Dolores was down in the aft cabin trying to accustom herself to the fact that on the return journey she would be no longer Dolores Parede Castanho, but Exma Sra. Preto, a blushing, if unwilling, bride.

Profit and prospective romance caused Juan to offer a prayer of thanks to the gods ! He remained on deck soliloquising while the first mate navigated the *Celeste* safely into the Saronne harbour.

The first mate, too, saw to the faked customs papers for those tiresome officers of the *alfandega*.

Juan the skipper, Juan the lover, did not want to bother himself with these mundane details.

When the *Celeste* was safely tied up he walked the deck with a light heart to tell Dolores that they were on Moroccan soil again, and that she must prepare for the festivities.

But when he entered the *camarote* and found that Dolores had flown, he spat violently and cursed volubly.

◆ ◆ ◆

As Robert Everett was putting the finishing touches to the five-metre aerial feeder leads out on the hill facing Saronne harbour, he heard a slight rustling noise.

Looking up sharply he saw a pair of brown eyes looking at him solemnly over the edge of the *parede*.

He forgot radio technicalities for a moment.

" *Como esta o.* . . . " It was not a bad attempt at Portuguese, but Dolores noticed the British accent. She had learnt English, you see, back at the old *escola* of Santa Marina.

" Good morning " . . .

She looked with feigned surprise at the maze of aerial and counterpoise leads. At the back of her the sun glittered on the horizon line of the harbour and silhouetted her dark hair. Everett, who had spent an early morning studying microwave radiation, thought she was adorable.

She looked so out of place among the wires of the cliff radio station.

" What is it you do ? "

" You'd never understand," Everett laughed.

She smiled mischievously. " Ah, but I wish to."

By the time the old bell chimed another hour in the Largo da Se, Dolores was roughly acquainted with the workings of the short-wave beam transmitter carrying out beam tests between Saronne and the Gibraltar side.

" It is wonderful. But I shall never understand."

She sighed.

" You see," explained Everett, " I spent five years with the International Communication Board before coming out here to Morocco. We are trying to get a contract with the French Government, but it looks as though I shall be stuck out here another two years before anything is done. . . .

" You will come back ? "

" If Juan will let me."

" Juan—Juan—you seem terrified of this Juan. He cannot marry you against your will, and if Maria does not wish it. . . . "

" You do not know Juan. . . . But I must go. The *Celeste* will sail as soon as he has unloaded the cargo. . . . I must go with him back to Lisbon and stop Maria from worrying."

" The *Celeste* ? "

" That white boat down there in the harbour—see, just to the left. . . . "

" Yes," said Everett thoughtfully, " I have seen it come in to the Saronne harbour when we are carrying out our tests."

He watched Dolores climb down the cliff road that winds round to the harbour. Then, still deep in thought, he went back to the transmitter.

◆ ◆ ◆

Three days later the *Celeste* came back again to Saronne, and within ten minutes of its tying up, Dolores peeped round the aerial switchboard rack at Everett, busy in his shirtsleeves, adjusting a master oscillator.

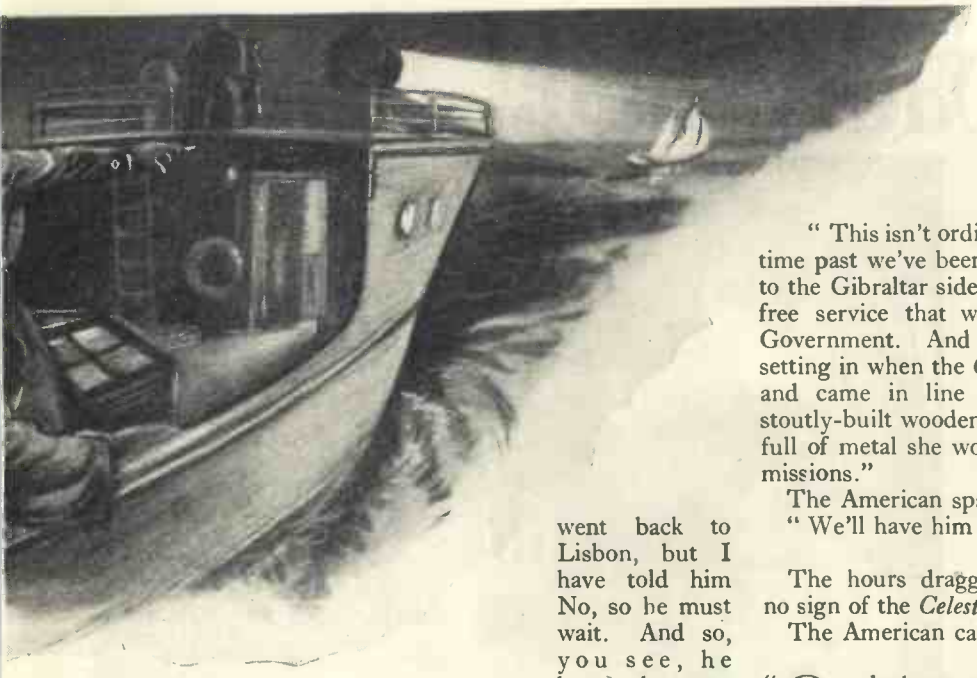
" So. I have come back." She smiled roguishly.

" Dolores ! I have been expecting you."

" Me ? "

" Yes, I got a message here from the Gibraltar side that the *Celeste* was on its way. But tell me. . . . You are not Mrs. Preto yet ? "

She laughed harshly. " He whipped me when I



Long Complete Radio Story by KENNETH ULLYETT

went back to Lisbon, but I have told him No, so he must wait. And so, you see, he brought me again to Saronne. He thinks I will marry him when we get back to Lisbon. But not I, a Castanho."

Everett smiled inwardly at this show of bravery.

"Dolores," he said, "I have something even more serious to ask you. This Juan . . . What does he carry on the *Celeste*?"

"Corn—no—what you call . . . maize. Why do you ask?"

"Truthfully, you do not know that he carries anything else?"

"Why, no!" She looked up in surprise.

He switched off the generator and 'phoned through instructions to the officers' quarters of the station. A car was waiting on the narrow cliff road and they sped down through the dusk to the harbour. . . . Along the docks to where the *Celeste* had tied up.

But the *Celeste* had vanished.

◆ ◆ ◆

Everett secured the harbour master's 'phone and gave instructions to the radio station. Within five minutes a fast motor launch zoomed round to the quayside.

"Don't leave me . . . Bob."

Everett looked down at her pleading eyes. It was risky. The officials might take a serious view of a mere slip of a girl being passenger in such a dangerous trip. But then, she would be essential for identifying Juan. How could he resist her?

With a pilot at the wheel, and with a searchlight blazing over the darkening water, the launch moved quickly off from the Moroccan coast.

The American lieutenant in charge of the Launch Section from Casablanca came down aft.

"This looks like a sure catch."

"If we can get him before he's too far off the coast."

"But it was sure a smart piece of work on your part, buddy," pressed the lieutenant.

"Smart? Well, you see, up at the Saronne radio station we had our eye on the *Celeste* for the past fortnight. That boat's been playing the dickens with our short-wave gear."

"Say, you're a radio man then? I was in the radio once myself."

"This isn't ordinary radio, lieutenant. For a long time past we've been sending a directional beam across to the Gibraltar side. We've been getting such a fade-free service that we've almost convinced the French Government. And then suddenly we had fading setting in when the *Celeste* entered the Saronne harbour and came in line with our beam aerials. She's a stoutly-built wooden boat, but if she hadn't been chock full of metal she wouldn't have upset our beam transmissions."

The American spat over the side.

"We'll have him within half an hour."

◆ ◆ ◆

The hours dragged on. Dawn came. There was no sign of the *Celeste*.

The American came down aft again.

"Our luck seems to be out, buddy. But the only good thing is that the way we've circled round has prevented the *Celeste* from getting anywhere near the entrance of the Tagus."

"And if we keep on, we shall get up the Tagus and into Lisbon before Preto?"

"Yeah, not for another ten hours! I doubt if we can stick it."

"How long will it take to get back to Saronne?"

The lieutenant shouted back the query to the man at the wheel.

"Five hours, sir."

"Yeah, about five hours, I'd say."

Everett considered. "Let's risk it. Even as it is, he might have slipped us and be half way up the Tagus by now. We might be too late to stop him at the harbour. If we get back to Saronne, I can use the beam to get a message quicker through to the Lisbon harbour officials than we could do any other way."

The searchlight spread over the blank waterfront, and the American looked grim.

"Your durned radio got us into this mess," he said bitterly. "I'll risk it getting us out of it!"

◆ ◆ ◆

Away at Lisbon Juan Quixote Preto stepped confidently down the gangway. He had seen the Government launch turn back to the Moroccan coast.

But now here was his beloved Lisbon and safety.

He handed his papers briskly to the *alfandega* officers on the harbour edge.

"Juan Quixote Preto?"

"*Perdoe-me.*"

The Customs Officers looked strangely serious.

"*O capitao Celeste?*"

"*Si!*" Juan hesitated.

A firm hand was laid on his shoulder and, in the grip of officialdom he was conducted to the quayside office while a Customs Officer went on board.

◆ ◆ ◆

"It is wonderful," said Dolores, "but I shall never understand it. It is wonderful . . . beautiful!"

"No," said Everett. "It is you who are beautiful."

Wireless Magazine. December, 1933

What Broadcasting Can Learn

This article deals with inside facts about film making and shows how we may get better broadcasting by copying film technique.

By ANTHONY WEST

ONE of the few men who really do know how things should be carried on in the British film studios is Oliver Baldwin. He has directed so many successful British films and has been responsible for the starring of a number of broadcasting personalities. So his opinion of sound in film production is worth considering.

He is of the opinion that really beautiful voices that are so effective on the wireless are not looked for in films as much as they should be, but then sound has not yet come into its own. When one remembers the use Mamoulian made of a whisper in Dr. Jekyll and Mr. Hyde, one can see the possibilities.

The way the Germans and Russians, says Oliver Baldwin, use music to enhance a scene should be a lesson to us, and the noise of the turbine in the Russian film, *Counter Plan*, was one of the most dramatic effects that the art has given us. It is the use of these background noises that gives an added range to films and when they are not made full use of the stage performance is generally infinitely preferable.

But we must agree, however, that while film technicians have done good work in faking film sets, so that large exterior shots can be taken inside the studios, they must hand the palm to broadcasting engineers for the creation of really faithful sound effects.

It is possible that absolute drama is better conveyed through the medium of radio than it is by the screen. We see so much with our eyes and take so much for granted, whereas a definite impression created by sound is liable to be more concrete if only the listener's concentration is at a greater level than that of the average cinema patron.

Broadcasting is an older art even than the talkies, but I am of the opinion that both from the points of view of electrical and production technicalities, the film studios can set an example to the radio studios.

As a matter of fact, in this country the commencement of film recording and reproduction can be identified by a demonstration by C. F. Elwell at the Finsbury Park cinema in July, 1923. It was not until 1927, however, that big commercial backing was put into film recording. It is because the box office receipts provided such amazing revenue for the American film industry that so much progress has been made.

Broadcasting engineers have yet to realise a fundamental difference between handling speech and music for recording and reproduction.

As proof of this, shut your eyes for a while when next in a cinema and listen to the loud-speaker reproduction of the talkie film equipment. Speech is frequently distorted in tone level, but is nevertheless readily understandable. It represents a standard of reproduction which, while not perfect, is nevertheless capable of being listened to without confusing the hearer. There is, in many cases a frequency cut-off, but then it is acknowledged that the frequency range required for the effective transmission of speech is not the same as that for music.

Music handled by a talking film equipment is generally not so good as the speech. The frequency cut-off is here more noticable and the recording engineers do not pretend that with present systems of recording and reproduction music is given with that purity which characterises good quality radio reproduction in the home.

Radio results are generally the reverse of those obtained with a film system. A really good set, giving 1¾ to 2 watts output to a moving-coil loud-speaker system is capable of giving first-class musical reproduction. Speech, however, is frequently boomy and definitely not so intelligible nor so pleasant to listen to for protracted periods, as the dialogue of a talking film.

It must be remembered that the reproduction factors in the case of a talkie film equipment in a large cinema are different from those of

from the Film Studios

The left-hand photograph shows Spencer Tracey and Colleen Moore playing a scene in "The Power and The Glory," while above is James Wong How "shooting" a scene in the same film. As a contrast, the photograph on the right shows a scene in a Broadcasting House studio during the production of a television revue. Harry Pepper and John Watt directing the production. The positions of the photo-cell banks for television are just as important as the positions of the spotlights in the film studio views.

a good radio loud-speaker arrangement in the home. Frequency cut-off is allowable in a large hall to prevent resonance, whereas in the more confined space of the average room a wider frequency range must be covered.

In many cases the poor speech response is due to technical faults at the broadcasting end. Two of the photographs on the next page show how the microphones are arranged in film studio work. Elaborate precautions are taken to shield the microphones and in some cases to obtain a directional effect.

This enables the "mikes" to be placed further away from the speakers, which in many cases is an advantage as it prevents that boomy reproduction so frequently heard on the radio and which is caused only by the speaker being too close to the microphone diaphragm.

When a radio set is working at full amplification on a local station, it is possible to detect the slightest rustling of the manuscript leaves as the speaker reads his talk, and even to note the announcer's intake of breath.

The result is that as the microphone is placed closer to the speaker than would be average hearer's ear, a kind of "intimate" effect is obtained, which is not only unnatural but which definitely spoils the intelligibility of speech.

If for studio production reasons it is desired to keep the microphones close to the speakers, then the broadcasting engineers would be well advised to cut some of the bass response on speech in order to obtain cleaner reproduction.

The B.B.C. is not the only broadcasting organisation with a policy of strict adherence to "straight-line" transmission, which is supposed to give equal amplification at all frequencies and with a perfect receiver would, in theory, give perfect reproduction.

The facts prove that in practice this does not obtain, and as the talkie film engineers are more definitely affected by public opinion (through the medium of box-office receipts) than are the engineers behind broadcasting, they were quicker to realise that cinemagoers did not demand technically perfect reproduction.

They want film music and dialogue which is easy to listen to

FILMING A WAR SCENE
A special type of microphone was used by the Gaumont British engineers during the "shooting" of a new war film recorded near Croydon

and which appears "natural." These results, it seems, are not obtained with the radio idea of straight-line reproduction.

On the production side broadcasting has much to learn from film technique. You may be a stern critic of cinemas and you may not be a lover of radio plans, but you must admit that the average film is more entertaining and frequently more educational than the average broadcast play. So those who have spent many years in perfecting film reproduction should be expected to have experience of value to the broadcasters.

The B.B.C. is about the only broadcasting concern which has made a serious attempt to portray drama on the air. When Cecil Lewis went to America he found that the National Broadcasting Company and Columbia Broadcasting System studios were far behind the B.B.C. in the way radio plays and radio sound effects were broadcast. In Europe the Reisch Rundfunk studios gave many radio plays before the present preponderance of Nazi propaganda, but their technique is not up to ours although the B.B.C. has actually broadcast at least one play previously given in Germany.

Criticisms of the way in which broadcasting lags behind the film studios in the control of drama must therefore be more directly aimed at the B.B.C. One is tempted to think that the multi-studio idea is overdone.

The film engineers used banks of microphones controlled at what the B.B.C. calls a D.C.P. (dramatic control panel) previous to the introduction of multi-microphone control for radio play broadcasting, but films are not made simultaneously on a number of sets in any way comparable with the production of one radio play in a number of studios. The system adds to the complications and does not appear to improve the results.

During the past few months the B.B.C. has partly dropped the multi-studio principle and has used a number of microphones in one large studio, echo effects being obtained with a microphone right at the back of the concert-hall studio of Broadcasting House.

If this idea is developed, broadcasting engineers will have to make use of the travelling microphones so familiar in the film studios.

When plays are carried out in one studio again, then it will be possible to get a smoother production without technical delays. In the early days of film making, when the value of time in production was not fully realised, there were too many technical delays.

Sets had to be built, lights erected, focused, camera positions chosen, and the set cleared of all debris before shooting began. In the middle of a scene the light might have to be changed, or the camera or sound film camera reloaded. By a process of system the film producing have overcome these difficulties, so that films are made continuously day and night in the studios.

The same system must be applied to broadcasting to speed up production.

When perfected colour photography causes the cinema to rival the stage, and successful television results in broadcasting rivalling the cinema, then broadcasting will be glad of any experience it can gain from the film studios.

FILMING CAVALCADE
The London Square scene in "Cavalcade" is here being recorded for the film. The sound engineers are on the balcony directing the position of the reflecting screen on the left and of the two travelling microphones on poles

Using Tone and Volume Controls

By PERCY W. HARRIS
M.Inst.Rad.E.

HAVING heard so often the remark, "My new set is fine, old man—sounds like the real thing," I am tempted to write a few notes about that elusive "real thing" and why so many people fail to make the best of the two little knobs for tone and volume control, which form a feature of so many modern receivers.

Straight-line Curves

Now, reproducing the "real thing" is a complex matter. At one time, manufacturers vied with one another in marketing low-frequency transformers and resistance capacity units with marvellous curves showing a straight line up to about 8,000 cycles, suggesting thereby, that one had but to fit their particular units to obtain "perfect quality." Seeing that any "straight-line" amplifying unit can, at its best, only reproduce faithfully what is put into it, and as moreover these devices are all placed *after* the detector, they are bound to pass on any distortion of tone which comes from the detector, and—believe me—even in modern sets, the output from a detector is a considerably distorted affair!

It took some years for manufacturers and set builders to realise that the kind of characteristics possessed by the cheap type of transformer (rather deficient bass and a peak in the high-frequency part) needs comparatively slight modification in order to make it a compensating device for distortion introduced prior to the detector. The more intelligent designers then realised that, after all, what reaches the human ear is the only thing that counts, and that distortion at the high-frequency end in the low-frequency part and in the loud-speaker might all be arranged to balance out, and so produce a good effect to the ear, even when the characteristic of any individual part was hopelessly distorted.

American manufacturers were the first deliberately to design loud-speakers having a resonance in that part of the audio-frequency spectrum in which their sets were deficient and this principle has now been adopted almost universally.

Pre-detector distortion is not a constant matter. Save in sets which have been specially designed to overcome the defect, there is more distortion at the lower end of the tuning scale than at the upper, as most sets tune more sharply there. In the Stenode—which was introduced some four years ago and which so badly upset all those superior people wearing their old technical school ties, by reason of the fact that it upset so many preconceived ideas—the sharpest possible tuning was deliberately introduced at the outset, the distortion introduced by this being compensated in the audio-frequency amplifier. Up to the time of the introduction of the Stenode, it was universally held that if you made tuning very sharp, thereby introducing distortion, and subsequently corrected this distortion in the audio-frequency end, you would bring back all the interference which sharpness of tuning had reduced or eliminated. The Stenode showed that this was not the case, sharpness of tuning was still retained after tone correction, and this point is now universally accepted in the scientific world with the result that tone correction is becoming an integral part of every modern design.

Output Results

A few paragraphs back I pointed out that obviously it is what reaches the ear that counts. The importance of this statement cannot be over emphasised. Imagine that you have a receiver giving to all intents and purposes uniform output from its loud-speaker at reasonable strength and that you place it in a room which, owing to its peculiar acoustical structure, partially absorbs all frequencies round say the 3,000 mark. Heard in such a room, reproduction will sound very bad—it will be "woofy," dull and generally unsatisfactory.

The output from the set you know to be good, so what is the remedy? Obviously, if you can *increase* the output from the set in those frequencies which tend to be absorbed by the room, the sounds reaching your *ear* will now be natural. Remove the set to another room which has a *resonance* round about the same range and your set will sound equally unpleasant in an entirely different way. Now reduce the response of the set to that band.

of frequencies and the natural tone will be restored.

By quoting these two imaginary cases I want to draw your attention to the fact that the same set sounds different in different rooms and that the reproduction of the " real thing " is as much a matter of the surroundings of the set as of the set itself.

Frequency Cut-off

But this is not the only aspect of sound and tone reproduction. Listeners vary enormously in their aural response, some being practically deaf to all frequencies above about 4,000, while others have sensitive ears which detect distortion in tone up as far as 9,000. Obviously, then, to give good reproduction of frequencies at the upper end of the scale is to provide something which some people appreciate and others cannot. This is why a set which sounds poor to some people sounds satisfactory to others. Then again, programmes differ. The band of frequencies used in the reproduction of speech is not the same as that used for the full orchestra. Intelligible speech can be transmitted on a very restricted band of frequencies as witness the perform of the Post Office telephone (when you get the right number !) This reproduces practically nothing below 200 cycles or above 2,500 yet we can follow what is being said. Intelligibility is included well within this range, but those subtle differences in tone which make us recognise an individual's voice are *not* transmitted, which accounts for the fact that in many cases people's voices sound entirely different on the telephone.

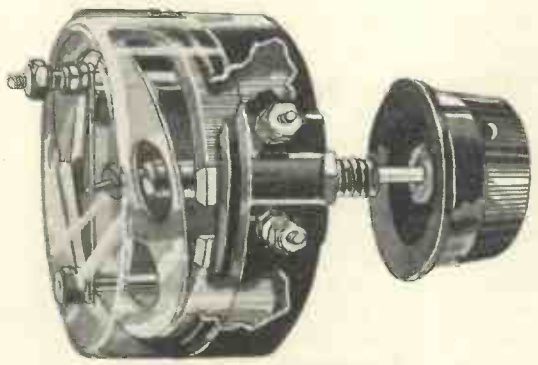
Intelligibility Limit

If we broadcast talks on a comparatively narrow band of frequencies intelligibility may be quite good but we might not be able to recognise the person speaking by his or her voice. The proper and accurate reproduction of speech, however, including all those nuances which enable us to identify the person, requires a band of frequencies which is scarcely covered satisfactorily even by quite expensive wireless sets. If, however, you are only concerned with intelligibility of talk, then a relatively poorer set may do.

An astonishingly large number of people use wireless programmes not for direct listening but as a kind of indirect background to their general lives. I am one of those people who get extremely irritated if, during a news bulletin or musical item in which I am interested, somebody else starts talking. " All right, don't get annoyed, I can talk and listen at the same time ! " Who has not heard such a remark from one type of listener? Some people, indeed, seem scarcely able to live without the background of a wireless programme, be it music or talk, and for these we must consider another aspect of reproduction.

Long ago it was discovered in America that in those sets provided with what was politely termed a " tone control " but was really a device which practically eliminated all of the already attenuated " top," a very large number of listeners invariably use the set with the tone control turned over to the maximum position, thereby cutting out all of the vital (or what most of us would consider vital) high frequencies. A further consideration of the phenomenon showed that it was these frequencies which really attract the attention and give character to the reproduction and by " planing them off " the desired wireless background became less obtrusive.

A genuine tone control, with which some of the best modern receivers are provided, will allow not only for a reduction of top, but for a proper change of balance in tone, i.e. accentuation of the bass and reduction of the top or accentuation of the top and reduction of the bass so that the output from the receiver can be more or less adjusted to the acoustics of the surroundings. Then again, we must not ignore the fact that the response of the human ear differs considerably at different intensities. By this I mean that if you take a receiver which is giving a uniform reproduction (so far as the ear can detect) of all frequencies at a certain tone level, any considerable increase of strength uniformly over the scale will not *sound* the same.



INSIDE THE CONTROL

This cut-away sketch of a Lewcos pressure-contact-type potentiometer shows the metal plate which bears on the resistance element without any circular motion

Moving-coil Tone

The louder the reproduction, the more the bass will seem to predominate, which, incidentally, is one of the reasons why some moving-coil loud-speakers do not seem to give proper reproduction of bass unless they are run at considerable strength. When you go to the " movies " you sometimes think that reproduction is too loud and boomy, and if you look round you may see that the theatre is relatively sparsely filled. The controlling engineer can, of course, vary the volume to suit the absorption of the theatre and I remember spending some extremely interesting hours in the controlling room of the famous Roxy Cinema in New York where the chief controlling engineer explained to me that on a wet day the sound absorption in the auditorium was vastly increased, due to the fact that people, on coming in, took off their coats and hung them over the seats !

Volume and Tone

From this it follows that if you want your set to be turned up very loud you may have to alter the setting of the tone control, although on a lower volume the sound will seem perfect.

Then, again, we have the interesting phenomenon known as binaural reception which, acoustically, resembles stereoscopic vision in that in this latter by looking through a specially provided apparatus at a specially taken pair of pictures the various objects seem to " stand out " in relief. In binaural hearing (which is our normal way of hearing) we can detect pretty accurately the direction from which the sound is coming. In radio all the sounds come from one point in the loud-speaker, but recent work has been along the lines of making the sound appear to come from different directions just as it would in the concert hall or studio. But more about this in a subsequent article, as " stereoscopic " reception is not a topic to be dealt with briefly.

Mechanical Circuit Diagrams

By P. WILSON, M.A.

WHEN Graham Bell invented the telephone in 1876, no one could possibly have foreseen that the theoretical and practical developments of that elegant little toy would within fifty years hold a commanding position in the world of science.

A Monumental Treatise

In those days, electricity was only just coming out of the laboratory and beginning to affect the life of ordinary folk in the outside world. The theory of the subject had gradually been worked out and Clerk Maxwell had just published his monumental treatise in which, by relating many of the principles to already understood mechanical laws, he was able not only to prophesy the existence of electromagnetic waves through space, but also to provide a comprehensive basis on which the elaborate superstructure of modern times, relativity, electronic theory and the rest, could securely rest.

Circuit theory as such was practically unknown and, in fact, remained unknown for quite a number of years until the necessities of telephone engineering demanded the co-operation of the physicist and the mathematician for the solution of the many practical problems that were cropping up in everyday experience.

Attacking Problems

Between them the telephone engineers and these mathematical physicists have developed a method of attacking electrical problems which deservedly now ranks as one of the most potent weapons of analysis that we have. Most of the real progress has taken place since the war. Even just before the war, when I specialised in electricity and magnetism for my own degree course, the so-called " impedance " methods which were the basis of the new method, were brushed aside rather cavalierly by the orthodox University tutor.

Nowadays, circuit theory has been exalted into a pure science under the name of "The Operational Calculus" —which, at any rate, serves to show that the mathematician can be broad-minded.

It is now being discovered that many of the methods of this new science can be applied to the solution of mechanical and other problems for which the methods of classical mechanics have hitherto been too cumbersome.

The wheel has taken a complete turn. Maxwell used the methods of classical mechanics to advance the electrical theory; now electricity is paying back what it borrowed, with compound interest. This repayment was directly responsible for the tremendous improvement in gramophone technique, which took place in 1926; and it is continuing to be responsible for acoustical developments of all kinds, from the design of microphones and loudspeakers to the more exact knowledge of the properties of auditoria and of the physiological functions of the various parts of the human ear.

What more particularly concerns me in these articles is that the method enables one to construct a picture of the action of a pick-up which, though not quite comprehensive in that certain characteristics have to be ignored in the first instance, yet does serve to clarify one's ideas to a very considerable degree.

It is probably true to say that before long the first thing that a designer of a delicate instrument concerned with mechanical vibrations will do will be to try to set down the appropriate electrical circuit diagram which corresponds to the mechanical construction.

In electricity we are constantly concerned with such things as charges, currents, voltages (or electrical potentials), resistances, inductances and capacities. In mechanics, on the other hand, we deal with displacements over specified distances, velocities or speeds, forces or pressures, frictional or viscous resistances, masses and springs. It has long been known that there are analogies between the two sets of quantities; that is, that corresponding to a mechanical problem in which one set of quantities is involved, there is an electrical problem involving the other set and that there is a striking similarity between the solutions of the two problems. Many writers on electrical subjects have used this principle of analogy in its simplest form to explain, for example, what is meant by Ohm's Law (Current in amperes = voltage divided by resistance in ohms). Thus, they have compared the current in a wire to a head of water flowing through a pipe under the pressure from the mains. They have even gone a step further and illustrated the action of a condenser in passing on alternating currents by supposing that a flexible membrane were stretched across the pipe so as to stop the passage of water but not the passage of an *alternating* current.

Circuit Analogy

Most readers, by this time, will be familiar with these illustrations. But how many realise that the vibratory motion of a mass M attached to a spring S is exactly analogous to the behaviour of an oscillating electrical current in the familiar closed circuit formed by the inductance L and the capacity C as shown in Fig. 1? All my readers know that the electrical circuit is tuned, that is, that it has a natural frequency and is more susceptible to currents of that frequency than to others. So is the mechanical circuit. In the one case, the natural frequency is given by the formula

$$f = \frac{1}{2\pi\sqrt{LC}}$$

In the other it is given by the formula

$$f = \frac{1}{2\pi}\sqrt{\frac{S}{M}} \text{ or } \frac{1}{2\pi\sqrt{M/S}}$$

where S is the *stiffness* of the spring.

Compliance

In all problems such as this, an inductance corresponds to a mass and a capacity corresponds to the reciprocal of a stiffness. As it is inconvenient always to have to talk in terms of reciprocals a new term has been coined to represent the reciprocal of a stiffness, namely, *compliance*. A piece of indiarubber, for example, has little stiffness, but a large compliance. The " spring " in a bar of steel, on the other hand, is very stiff and therefore has a small

TABLE OF ELECTRICAL AND MECHANICAL ANALOGUES

ELECTRICAL		MECHANICAL	
Quantity	Unit	Quantity	Unit
Charge	Coulomb	Displacement	Centimetre
Current	Current	Velocity	Cm/sec.
Voltage	Volt	Force	Dyne
Resistance	Ohm	Resistance	Dyne sec/cm.
Inductance	Henry	Mass	Gram
Capacity	Farad	Compliance	Cm/Dyne
Reactance	Ohm	Reactance	Dyne sec/cm.
Impedance	Ohm	Impedance	Dyne sec/cm

The units for mechanical resistance, reactance, or impedance are sometimes called mechanical ohms.

compliance and corresponds to a small electrical capacity.

Examining in this sort of way a large number of corresponding electrical and mechanical problems, we are able to construct a table of analogues such as that given on this page. From this table we can, with a little care, proceed to construct for most mechanisms (and under this general term I include acoustical elements such as air columns in a tube or a horn) the analogous electrical circuit.

Real Howlers!

Notice, however, that I have used the words " with a little care." They are important for a number of reasons, and it is not uncommon to find casual people going completely astray. I remember, for example, reading an article on pick-ups in a British wireless journal in which a number of electrical analogies were worked out. Every one of them was wrong and some were real howlers.

Let me just illustrate one or two of the puzzles.

In electrical circuits we are concerned with currents flowing in restricted paths, e.g., in wires through resistances, inductances, etc., all of which for the purpose of our calculations are equivalent to motions in one dimension, i.e., along a line. In our mechanisms, the motion may be possible in several directions, or over a surface (e.g., when a diaphragm moves).

Again, we distinguish in mechanics between linear motion and rotational motion. In order to construct the electrical analogy, every rotational motion has to be interpreted in terms of the linear motion of some appropriate part of the mechanism. Thus, to construct the electrical analogy of the rocking motion of the armature of a pick-up we interpret everything in terms of the motion of the fish-tail, or alternatively, of the needle point. This, by the way, is where the writer I mentioned just now went all astray.

Then, in electrical circuits we may have components either in series or in parallel with others. We have to be careful, therefore, when constructing a mechanical circuit diagram, to see that our masses and our compliances are rightly interpreted as series

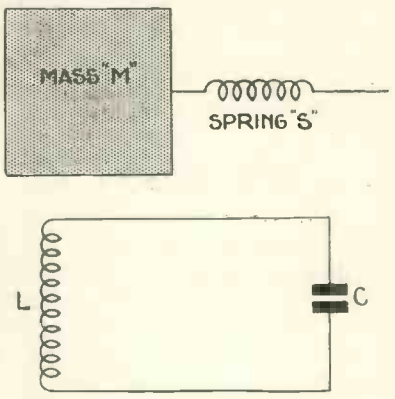


Fig. 1.—Simple mechanical and electrical analogue

or shunt inductances and capacities respectively. Some of the conclusions of a very famous paper by Hanna and Slepian on the design of horns and the action of the telephone mechanism in a horn loud-speaker, some years ago, were vitiated by errors of this kind.

By remembering a simple little dodge, however, these difficulties may almost always be avoided. The dodge is to think out what would happen if a capacity were made infinitely large or an inductance infinitely small. Thus, take the case of an infinite capacity. Electrically, it means that oscillations down to zero frequency are completely passed on (remember that the bigger the condenser, the less impedance it offers to lower and lower notes). In other words, it is a directly short-circuited condenser! Now think of its mechanical analogue, an infinite compliance. The greater we make the compliance the less stiff and the more flexible and string-like the spring becomes. It follows that a spring between two moving parts of our mechanism should always be represented as a shunt capacity since making the compliance infinite would stop all transmission of motion between the two parts. On the other hand, the spring between a moving part and a fixed part (e.g., the armature of a pick-up and a pole-piece) should be represented as a series capacity. The corresponding circuits are given in Figs. 2 and 3.

Some Exceptions

Finally, there are mechanical elements for which there is no actual electrical analogue. Thus the pull of gravity when it tends to restore a mechanism to its initial position of equilibrium corresponds to a spring and therefore, to an electrical capacity, but when it tends to overbalance the mechanism it corresponds to an electrical fiction, that is a *negative* capacity. In my last article, I illustrated the two types of case by a pendulum, where the pull of gravity is a restoring force and a billiard cue balanced on somebody's nose in which case the pull of gravity has an overbalancing effect. We come across a similar case of an overbalancing mechanical force in the case of a pick-up. The pressure between pick-up and record operates at the needle-point and as this is moved by the record groove to one side of the central position, the pressure tends to increase the displacement. It corresponds, therefore, to a negative capacity.

Magnetic pull usually has an overbalancing effect, though there are certain cases in which a restoring tendency may be provided.

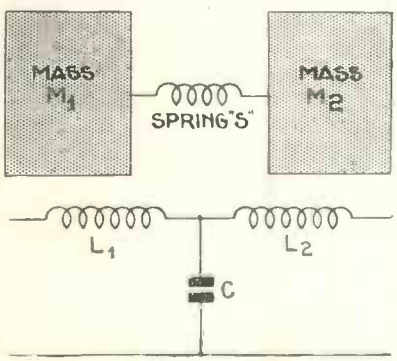


Fig. 2.—Spring between two moving masses represented as shunt capacity between two inductances

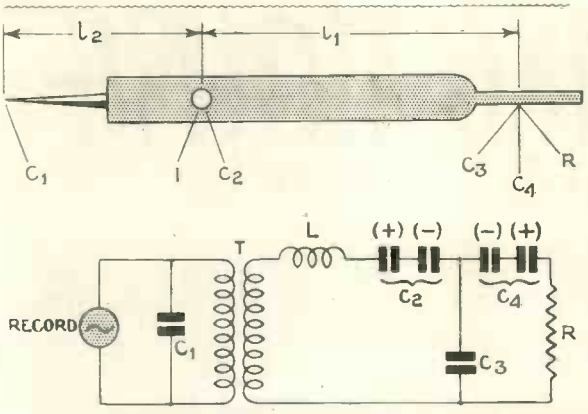


Fig. 5.—Circuit diagram corresponding to mechanical relations of the various parts of the pick-up armature

With these cautions in our mind let us see if we can build up a circuit diagram for the pick-up armature of the usual (or Kellogg) type illustrated in Fig. 4.

First of all, we notice that since the armature rocks about on axis we must "transfer" the various mechanical elements to their counterparts, either at the needle point or the fish tail. For rocking motion we are not concerned directly with the actual mass of the armature with which, for this purpose, we include needle and needle screw, but only with what is known as its "moment of inertia" about the axis. This is found by taking every particle of mass, multiplying by the square of the distance of that particle from the axis and adding up all the products. In practice, of course, we don't do this, since the value of the moment of inertia has been worked out mathmatically for various shapes of rotating bodies. The important thing to notice, however, is that particles at a greater distance from the axis of rotation make a very much greater contribution to the total moment of inertia than those close to the axis.

Determining Inertia

When we want a large moment of inertia, as in a fly-wheel, we use a heavy rim thus concentrating as much of the mass as possible at a large distance from the axis. When we want a small moment of inertia, as in a pick-up armature, we keep the mass as close to the axis as possible. That is why the needle-screw is put through the axis itself.

To transfer to the fish-tail we have to find the equivalent mass concentrated at that point which would have the same moment of inertia about the axis as the actual armature.

This equivalent mass is clearly the moment of inertia of the armature divided by the square of the distance between the fish-tail and the axis. This conclusion is important because it indicates that the equivalent mass, from this point of view, of a long armature need not be any greater than that of a short armature, even though in the latter case the actual mass and the moment of inertia may be considerably less. For, since the equivalent mass is equal to I/L_2 an increase of I may have no effect on the quotient provided that L_2 is proportionately increased.

A small equivalent mass is obtained by having the moment of inertia I as small as possible and the distance L between axis and fish-tail as great as possible, e.g., by making the bore hollow.

So much for the mass of the armature. Now what about the various compliances. Although the armature and needle may be made reasonably stiff, they cannot be assumed, when considering vibratory motions, to be perfectly rigid. There is always a certain amount of spring in them and unfortunately this spring cannot accurately be represented as being situated at any particular point or points. It is distributed. An examination of the structure of practical armatures, however, indicates that the larger part of it is situated either at the needle-point which, of necessity, has to be tapered or at the fish-tail which, for magnetic reasons is usually flattened so as to present a greater surface to the pole faces.

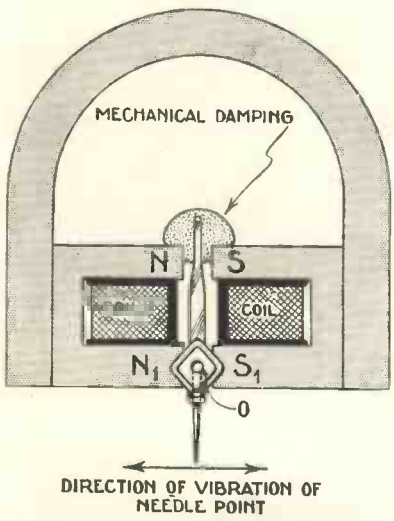


Fig. 4.—Arrangement of the Kellogg pick-up, originally introduced in 1927. It formed the basis of the B.T.H. model used in the Panatrope

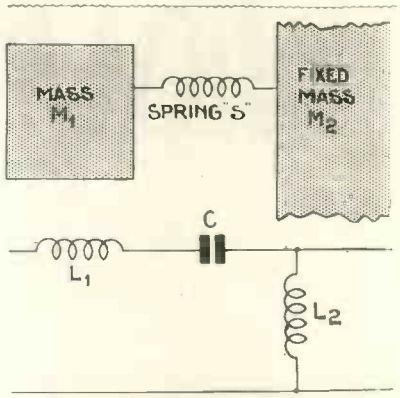


Fig. 3.—Spring between a moving mass and a fixed mass (which being fixed must be assumed to be infinitely large) represented as a series capacity

It should also be noticed that the pivoting of the armature in effect introduces a transformer of turns-ratio l_2/l_1 between the needle-point compliance and the other elements of the circuit. If l_1 is greater than l_2, the motion at the fish-tail would be greater than that at the needle point, and so the pressure there would be less. In that case, since an electrical transformer is a voltage device, we have to regard the transformer as a *step-down* transformer.

The impedance-ratio of this transformer will, as usual, be the square of the turns-ratio. (Compare, for example, the rule for matching an output valve by means of a transformer to the impedance load of a loud-speaker.)

These are our only shunt compliances. But there are two series compliances and two negative series compliances.

There is a series compliance at the rocking axis, caused by the rubber sleeving round the pivot. There is a series compliance at the fish-tail caused by the springiness of the damping between the armature and the pole faces. There is a negative series compliance at the fish-tail caused by the overbalancing pull of the magnet poles. And there is a negative compliance at the axis caused by the overbalancing tendency of the pressure on the needle-point.

Putting all these things together we get the mechanical circuit diagram shown in Fig. 5.

BROADCASTING HOUSE—

as a musician sees it.

By WHITAKER-WILSON

THERE is a good deal to interest a musician—or indeed any artistically - minded person — in Broadcasting House. Certain parts of it are perhaps more attractive to the electrically-minded visitor but, on the whole, there is an appealing atmosphere of art about the building.

The Concert Hall, for example, gradually grows on you when you have been in it a few times. It is essentially modern in design—but then the whole building is modern, so far as that goes—yet there is an atmosphere of peace and quiet so often absent in modern buildings.

If you happen to be in the hall alone you will be surprised at its complete silence. Sounds from the street do not interfere in any way. If you hold conversation with a companion you are not aware of any artificial trick being played on you with regard to the acoustic properties of the hall.

The reverberation period is as much as 1.75 seconds which, of course, is a very natural sort of period. Many buildings, far less carefully treated than the concert hall at Broadcasting House, have a similar period. For broadcast-purposes, especially for string quartets this period has much in its favour.

If you go to the vaudeville studio, which has a cubic capacity of 30,000 feet as compared with 125,000 in the Concert Hall, as well as a reduction to a fraction over a second's reverberation, you naturally become sensitive to the change. You feel you are in a room which has been treated for a purpose.

If you actually witness a vaudeville in progress you are left in no doubt. The performance is for broadcasting and for that alone. You are expected to realise that if you are privileged to see a vaudeville you must regard yourself a spectator of something not intended primarily for your pleasure at all. It is like being at a dress rehearsal of a stage play.

The vaudevillists—at least those who know their business—do not take the slightest notice of the studio audience. They read from their scripts—some do it without the least action—and stand in front of the microphone so that you cannot even see them particularly well; but you are conscious that what you see and hear is indeed being sent out over half the world.

The same sort of feeling applies to the studio 8A, used for the Wireless Military Band. The reverberation is the same as in the Vaudeville studio, but the room is three thousand feet less in cubic capacity. Although you may feel an acoustical restriction in either of these studios when entering them from the corridors (not having previously been in any other acoustically-treated room) if you go into one of them after having been in, say, 6B or 7B (where the reverberation is down to .6 of a second) you will find an immediate sense of relief. If you go into them after having been in 4A or 4B, where there is literally no reverberation at all, you will begin to realise how powerful is acoustical control. The relief to the ears is amazing.

I once read a story about a prisoner (in Russia, I think it was) who was condemned to solitary confinement in a cell which had no reverberation period. Of all the fiendish acts, I cannot think of anything short of the Spanish Inquisition tortures, that could be worse. Silence, in the sense of peace and quiet amid pleasing surroundings, is one of the great things in life to experience; but artificially-contrived silence is quite another matter.

Not that the News studios are unpleasing. They are merely cubicles, but tastefully decorated and furnished, and the presence of conditioned air makes them habitable.

I have never made up my mind about conditioned air. I always feel I am breathing something that has had a good wash and cannot give me influenza, but there is something about it in the winter, when it has to be warmed, that is not too pleasing.

One of the most artistic studios is

that used for the religious services, but it never strikes me as being particularly atmospheric. Perhaps I am no judge.

I always enjoy sitting by the dramatic control panels. You would enjoy it also, but probably from another point of view; you are electrically-minded.

The dramatic control panel is no more a machine to me than the pistons of an organ. It does not interest me in the slightest that the unit can mix the output from eleven studios—even though the fact is really quite startling. It sets my mind working on the artistic possibilities it presents. I want to think out a situation in a play where I can make it do just what I like. I feel it has power because it can present to you three or four distinct situations so that you can assimilate them without the least strain. Recently they have tried the experiment of using several microphones in one large studio.

Occasionally I ask Val Gielgud to let me go and sit with him to listen to a play being rehearsed. The result is always the same. I come away impressed with something I do not understand technically, but which appeals to me artistically in the deepest sense.

Being a thorough baby, I like going to the effects room where I can play with some of the noises. I could tell you how most of them are done, but it is not fair to the B.B.C. to do it. In fact, I have been asked not to. After all, some of the effects are amazingly good and do really create atmosphere in the productions, but if you saw how they were actually done you would be sorry afterwards. It spoils the illusion. There again, to the writer who has his heart and soul in his work, the effects room is almost sacred. He knows he has merely to ask for certain effects to be produced and the thing is done. You would be surprised how much trouble the productions people will take over the least important of effects legislated for by an author. There is no noise in this world—or the next either—which they cannot put up *somehow !*

The music library is a place of wonder to me. I know many libraries, but not one anything like so complete as this. I have had, on occasions, to consult inaccessible works. Instead of wondering whether I shall find what I want at half-a-dozen libraries I customarily visit, I save time by ringing up the B.B.C. and asking if they have the work in the library. The answer is "yes" every time, and they are very nice about it. There is also a literary library quite well stocked.

So that you see Broadcasting House to a musician and/or author is a place of wonderment in many respects. He is allowed many privileges and never refused anything if it is at all possible for a request to be granted.

You would be surprised how hard the various heads of departments work and how desperately keen they are on making a success of their department.

If I go and see Val Gielgud over some idea I have in mind, I find him up to his neck in dealing with far better ideas somebody else has brought him, but he will hammer out the pros and cons of what I have laid before him until we either decide to reject it or adopt it in some form.

The same with Eric Maschwitz. He is different in temperament, and as big a baby as you could want, but he never ceases forming ideas for light entertainment. He knows as well as anyone that he will be criticised to the last degree.

Henry Hall is another. He has had approbation he will remember all his life, but he has been the object of criticism that would break a man's spirit entirely, unless he is determined *not* to be broken. To be head of the B.B.C. Dance Orchestra is not all joy, I may tell you.

Perhaps the least criticised is Christopher Stone. Nothing upsets him—at least, he always gives me that impression. He simply smokes that fearsome pipe of his and proceeds with whatever programme he has in hand.

I have given you a very rough outline of how Broadcasting House appeals to me who know so little about its technical devices. I have just gossiped away, which is perhaps the best plan when recording impressions. At all events, if you appreciate the fact that Broadcasting House is really what its Latin inscription says it is, you will appreciate the meaning of *Templum Artium et Musarum*—the Temple of Arts and Muses.

I am still of opinion that the B.B.C. programmes can hold their own with those of any foreign station, taken as a whole.

Failures are bound to occur because it is manifestly impossible to please everybody at the same time.

So long as the B.B.C. manages to please a small section of the listening community sometimes we need not complain too loudly at the fare provided.

STUDIO REALISM

Radio plays are conducted with vital movement in the German studios. This is supposed to help realism

The CLASS-B

In response to many requests the "Wireless based on the Quadradyne, the successful set minute in every

Just the set that you want for the winter months! A one-knob design that brings all Europe to your fireside and which every member of the family can work without trouble. Volume and quality as good as a mains set with economical running from dry batteries—that is what the Class-B Quadradyne can bring you this winter!

REALLY, this set should not be called a "Quadradyne" at all, because it has five valves, and "quad" would lead you to suppose that it had only four. But there is some excuse, we think, for the use of the word.

Eighteen months ago we described in the pages of "Wireless Magazine" a four-valver with two screen-grid stages that attracted considerable attention among constructors. This set has been built up by thousands of enthusiastic listeners, and for some time now we have been asked by correspondents to produce a class-B version of the original set.

Entirely New Set with Special Features

There are difficulties about that because many of the original parts are now obsolete. We decided, therefore, to design an entirely new set with certain features which would make it even better than the original.

You will realise now why we have called the set the Class-B Quadradyne; *it is the same type of circuit as the original* 1932 *Quadradyne, with a class-B output stage* in place of the pentode originally used. And, of course, as a class-B valve needs a driver there are five valves in the set altogether. Having explained which, we will look into other features of the design.

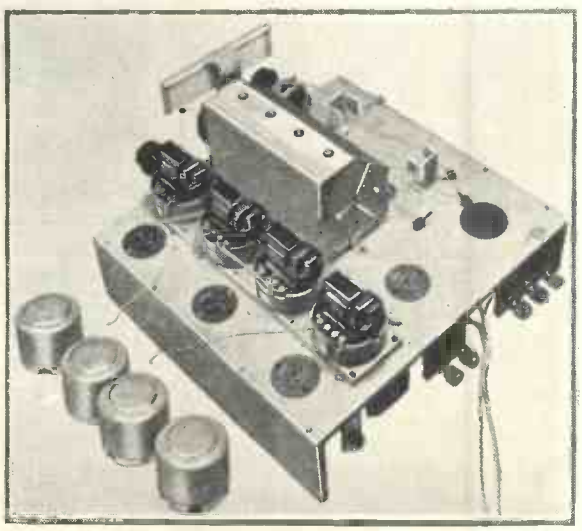
As the set has two high-frequency stages it naturally has to have a *minimum* of three tuned circuits. But we were out for *maximum* selectivity, so it was decided to incorporate a band-pass stage, as in the original design. The set thus finally contains four tuned circuits, controlled by a four-gang condenser to give one-knob control.

From time to time we have in these pages advocated in the case of sets with more than one stage of high-frequency amplification that the band-pass circuit should be placed between the first and second screen-grid stages, instead of in the aerial circuit. This removes the aerial damping from the two band-pass circuits and results in an improvement. The arrangement of the tuned circuits is therefore a single coil in the aerial circuit, a band-pass (two-coil) arrangement between the first and second screen-grid valves, and a fourth coil between the second screen-grid stage and the detector.

All four coils are of the latest iron-core type and the selectivity of the set is therefore comparable with that of a super-heterodyne, as will be evident from the test report reproduced on page 498 of this issue.

It is true that there are four trimmers on the four-gang condenser to be adjusted, but this will not trouble the experienced listener. That much, at least, was proved by the popularity of the original Quadradyne.

The class-B stage follows standard practice, except that the class-B valve itself is of the type that takes a small amount of grid bias. The advantages of this



IRON-CORE COILS FOR SELECTIVITY

The four iron-core coils used in the Class-B Quadradyne give the set almost super-het selectivity. Here you see the coils with their cans removed

QUADRADYNE

Magazine" Technical Staff here describes the construction of a class-B receiver with two screen-grid stages described in February, 1932. This set is up-to-the-respect, and will meet most listeners' needs for 1934

have been explained in previous issues of "Wireless Magazine."

It will be appreciated from the photographs which appear in these pages that the control of the set is extremely simple, there being only three controls on the front. On the left is the volume control (with which is combined the on-off switch); in the centre is the main tuning control; and on the right is the wave-change switch.

In practice one has only to turn the volume control to maximum, adjust the wave-change switch to the desired wave range, and turn the centre knob to hear stations from all over Europe come romping in on the loud-speaker.

Simplicity of Control and Construction

This simplicity extends beyond the control of the set; it is more than ever apparent in the construction. Just take a glance at the quarter-scale reproduction of the blueprint, which appears on page 496. Note that all the wires fall clear of one another and can be followed without confusion though the set is built up on the chassis principle.

There are great advantages in the chassis form of construction, which is slowly but surely finding favour with the knowledgeable constructor. It cleans up the appearance of the receiver wonderfully and also improves the results from the electrical point of view for two reasons—leads between components can be kept short and direct, and there is ample screening between parts that need to be screened from one another.

It will be seen in this case that there are very few parts on the top part of the chassis; in fact, there are only the four-coil assembly, the four-gang condenser, the volume control, the 9-volt grid battery, and the five valve holders. All the other parts are arranged on the underside of the chassis.

But before we go any further, we had better point out that the chassis is not made of metal. It is, in fact, built up of the new metallised wood, which is in every way as good as sheet metal and very much easier for the constructor to work. The necessary holes can be drilled through the wood without difficulty, whereas it would not be so easy to make the holes in an ordinary metal chassis.

Although the details essential for the construction of the set are included in these pages, we realise that many amateurs will prefer to work from a full-size blueprint. One of these can be obtained for half price, that is 9d., post paid, if the coupon on the last page of the issue is used by December 31. Ask for No. WM344, and address your application to "Wireless Magazine" Blueprint Dept., 58/61 Fetter Lane, London, E.C.4.

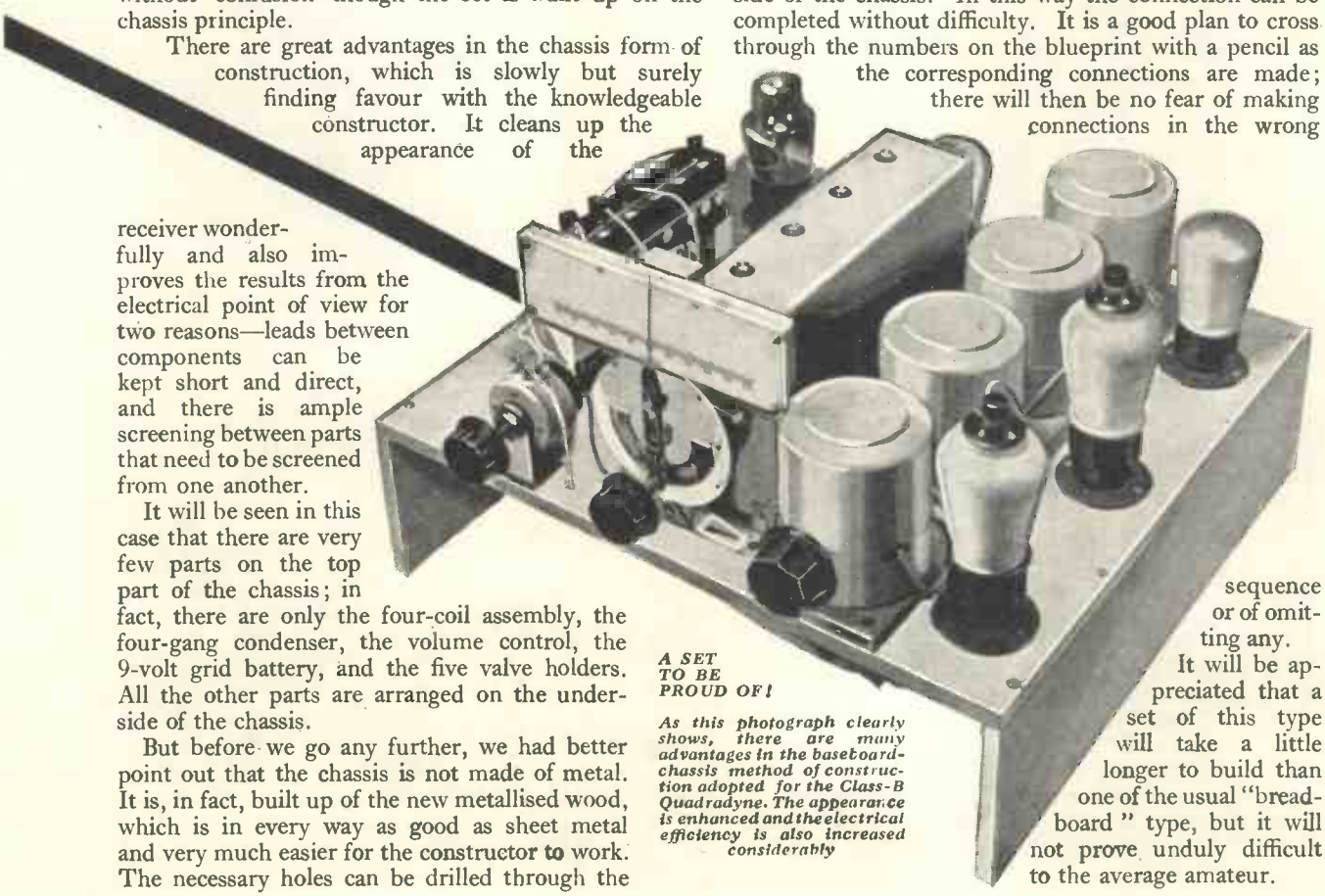
Blueprint Arranged in Two Parts

It will be seen that the blueprint (of which a quarter-scale reproduction appears on page 496) is arranged in two parts; the upper part shows the layout and wiring of the top of the chassis and the lower part shows the layout and wiring of the under-side of the chassis.

In every case the holes through which wires are led from the top of the chassis to the under-side are marked with small letters, such as *a*, *b*, *c*, etc. The wires themselves are numbered in the best sequence of assembly. *There will be no trouble about the connections if the numbers and the letters alongside the holes are carefully followed.*

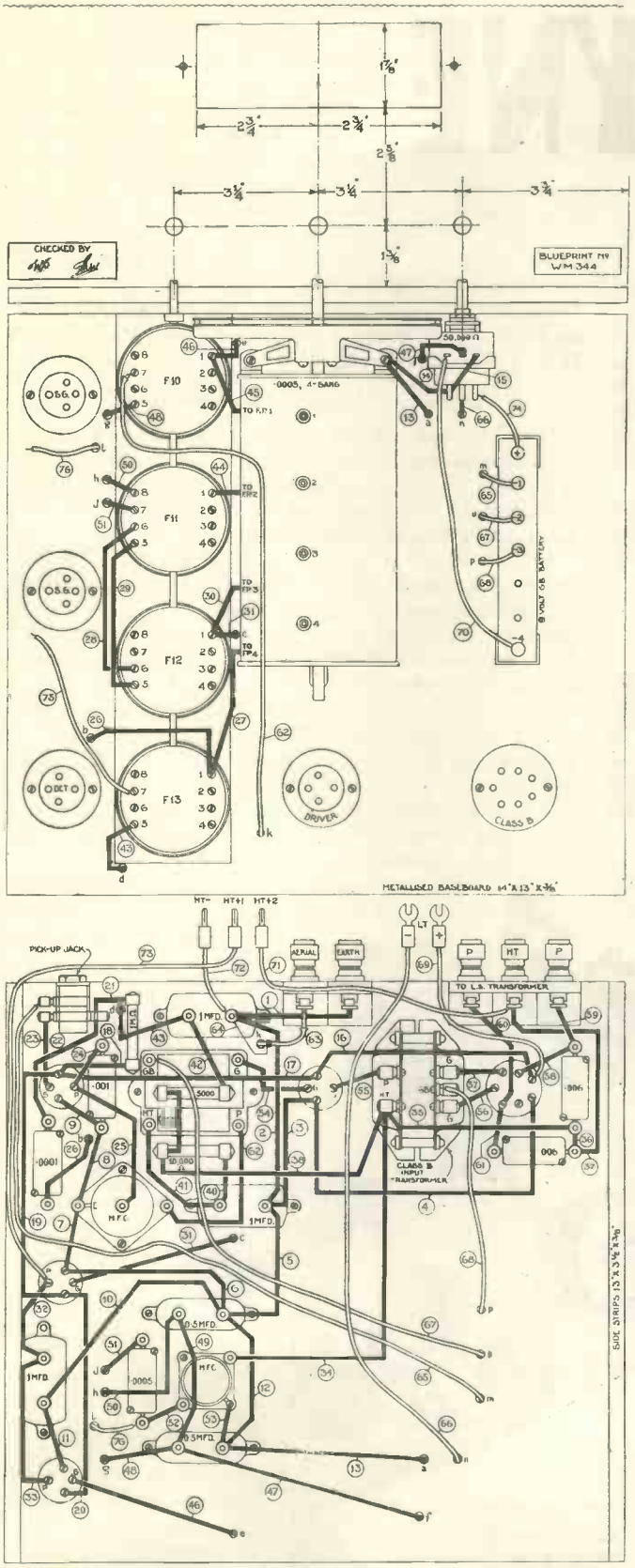
Start off with wire No. 1 and then proceed in the proper numerical order. When a wire passes through a hole in the chassis make a note of the letter alongside and then pick out the corresponding letter on the underside of the chassis. In this way the connection can be completed without difficulty. It is a good plan to cross through the numbers on the blueprint with a pencil as the corresponding connections are made; there will then be no fear of making connections in the wrong sequence or of omitting any.

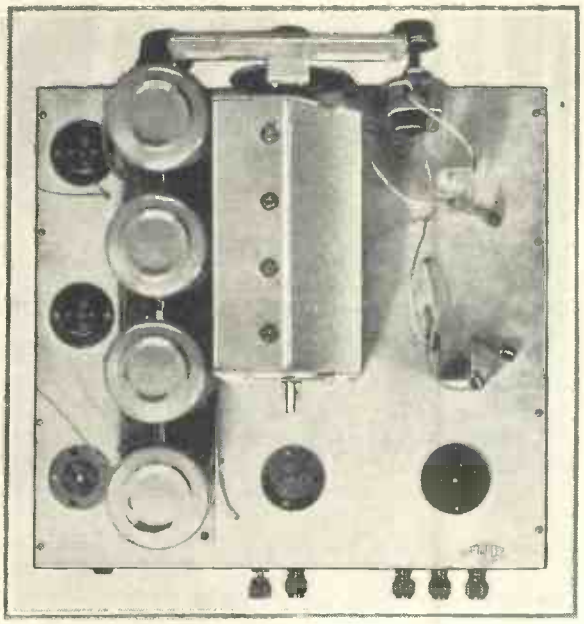
It will be appreciated that a set of this type will take a little longer to build than one of the usual "bread-board" type, but it will not prove unduly difficult to the average amateur.

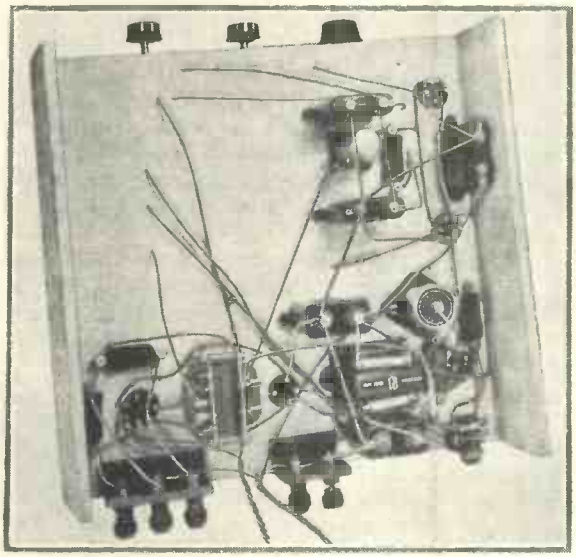


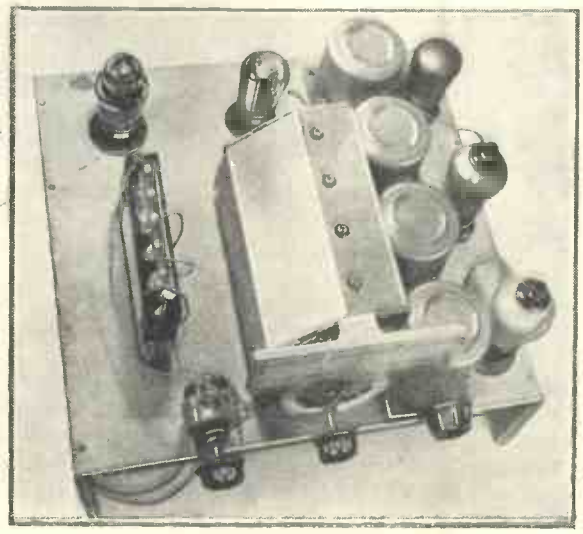
A SET TO BE PROUD OF!

As this photograph clearly shows, there are many advantages in the baseboard-chassis method of construction adopted for the Class-B Quadradyne. The appearance is enhanced and the electrical efficiency is also increased considerably









QUARTER-SCALE LAYOUT AND WIRING DIAGRAM

If desired a full-size blueprint can be obtained for half price, that is 9d., post paid, if the coupon on the last page is used by December 31. Ask for No. WM344 when ordering

As far as the external connections go there is little to trouble about. There are only two high-tension leads, that marked H.T.+1 needing 120 or 150 volts, and that marked H.T.+2 needing about 80 to 90 volts (for the screens of the screen-grid valves).

The valves are not at all unusual, but they are, of course, the latest types. That is, the screen-grids are the new short grid-base variable-mu type, and the driver valve and the class-B are also of a special type. If it is desired to use any other type of class-B output valve it will probably be necessary to change the driver transformer.

Use of Pick-up

As shown, the circuit is arranged for the use of a gramophone pick-up. This is put into operation by means of a plug, which is inserted when required into a jack mounted at the left-hand side of the chassis (looking from the back of the set). The circuit is switched so that no radio signals can leak through and spoil record reproduction when the pick-up is in use.

The constructor has a wide choice of cabinets for the Class-B Quadradyne. That recommended in the list of parts is of the table type and does not include the loud-speaker. It is found that many constructors already have cabinet loud-speakers that they want to use with any new set they build. There is also a tendency for this state of affairs to return; it is thought by some people that the quality of reproduction is better when the loud-speaker is housed in a separate cabinet from the receiver itself.

As the set is already provided with pick-up switching arrangements many constructors will prefer to build it straight into a radio-gramophone type of cabinet. In that case it will be convenient to mount the pick-up jack on the motorboard alongside the pick-up itself. Then it will not be necessary to put one's hand round to the back of the set to make the change-over from radio to gramophone and *vice versa*.

With this set the listener has the whole of the European ether at his command. It will be clear from the test report on page 498 that there is no end to the number of stations that can be picked up once the trimmers on the four-gang condenser have been adjusted properly. This is not as difficult as it may seem to the uninitiated.

Tune in a fairly weak station with all four trimmers set at about the half-way position and then readjust them one by one (whilst slowly moving the main dial about the point of tune) until the maximum signal strength is obtained.

It is as well to try trimming the set in this way at the lower end of the medium waveband and then at the upper end. In this way the best compromise will be obtained and the best all-round results will automatically follow.

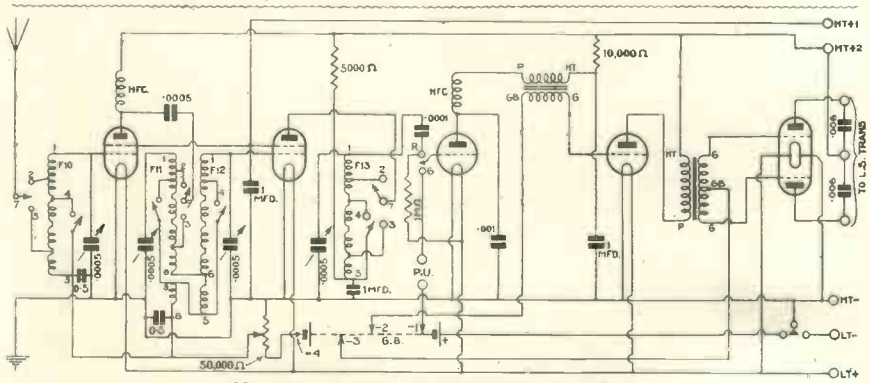
If A.C. mains are available it is a good plan to use a mains unit for the high-tension supply.

COMPONENTS NEEDED FOR THE CLASS-B QUADRADYNE CHASSIS

	£	s.	d.
CHASSIS			
1—Peto-Scott to specification	0	3	6
CHOKES, HIGH-FREQUENCY			
1—Telsen, standard screened, type W341 (or Bulgin, Wearite)	0	2	6
1—Wearite screened, type HFP (or Goltone, Telsen)	0	3	6
COILS			
1—Set Colvern, types F10, F11, F12, F13, mounted on one base	2	10	0
CONDENSERS, FIXED			
1—Dubilier .0001-microfarad, type 670 (or Telsen, T.C.C.)	0	1	0
1—Dubilier .0005-microfarad, type 670 (or Telsen, T.C.C.)	0	1	0
1—Dubilier .001-microfarad, type 670 (or Telsen, T.C.C.)	0	1	3
2—Dubilier .006-microfarad, type 670 (or Telsen, T.C.C.)	0	3	0
2—Dubilier .5-microfarad, type BB (or Telsen, Graham-Farish)	0	3	6
3—Dubilier 1-microfarad, type BB (or Telsen, Graham-Farish)	0	7	6
CONDENSERS, VARIABLE			
1—British Radiophone four-gang .0005-microfarad, type No. 420 complete with straight line drive	2	0	0
HOLDERS, VALVE			
4—Clix four-pin chassis-mounting	0	2	8
1—Clix seven-pin chassis-mounting	0	1	0
PLUGS, TERMINALS, ETC.			
8—Belling-Lee wander plugs, marked: H.T.+2, Screen, H.T.—, G.B.—4, G.B.—3, G.B.—2, G.B.—1, G.B.+(or Clix, Eelex)	0	1	4
2—Belling-Lee wander plugs, marked: L.T.+, L.T.— (or Clix, Eelex)	0	0	4
5—Belling-Lee Terminals, marked: Aerial, Earth, H.T.+, LS (two) (or Clix, Eelex)	0	2	6
RESISTANCES, FIXED			
1—Dubilier 5,000-ohm (or Erie, B.A.T.)	0	1	0
1—Dubilier 10,000-ohm (or Erie, B.A.T.)	0	1	0
1—Dubilier 1-megohm (or Erie, B.A.T.)	0	1	0
RESISTANCES, VARIABLE			
1—British Radiophone 50,000-ohm and combined three-point switch, type No. 434 (or Bulgin VS 30, Sovereign)	0	8	6
SUNDRIES			
5—Goltone terminal mounts	0	1	10½
2—British Radiogram 2-in. metal mounting brackets	0	1	0
Pair Bulgin grid-bias battery clips, type No. 1	0	0	6
1—Igranic jack, type No. P72	0	1	6
1—Igranic plug, type No. P40	0	1	3
Round tinned-copper wire for connections, No. 20 gauge (Lewcos), say	0	0	9
Oiled-cotton sleeving (Lewcos), say	0	1	6
2 ft. screened sleeving, say	0	0	6
4 yd. thin flex (Lewcos), say	0	0	4
TRANSFORMER, LOW-FREQUENCY			
1—Wearite class-B driver, type BJ21	0	8	6
1—R.I. Dux (or Lissen, Varley)	0	6	9

ACCESSORIES

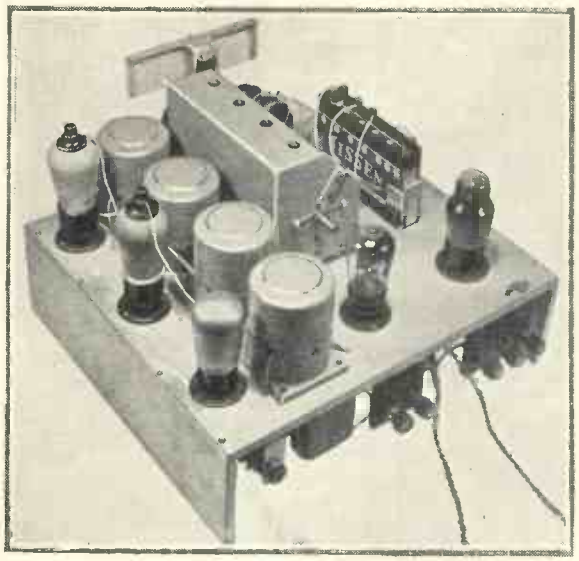
	£	s.	d.
BATTERIES			
1—Siemens 120-volt high-tension, type V8 (or Drydex, Fuller)	1	4	0
1—Siemens 9-volt grid-bias	0	1	3
1—Exide 2-volt accumulator, type CZ5	0	15	0
CABINET			
1—Peto-Scott model C.B.Q.	1	2	6
LOUD-SPEAKER			
1—Blue Spot for class-B cabinet model 62PM (or W.B., Igranic)	3	7	6
VALVES			
2—Cossor 220VS (or Mullard PM 12M)	1	11	0
1—Cossor 210 Det.	0	7	0
1—Marconi L21 (or Osram)	0	7	0
1—Marconi B21 (or Osram)	0	14	0
MAINS UNIT (In place of batteries)			
1—Regentone type W5A for A.C. Mains	3	15	0



CIRCUIT OF THE CLASS-B QUADRADYNE

It will be seen that the arrangement of the set is quite straightforward, except that the class-B valve is of the type that needs a small amount of grid bias

"On the Air" with the Quadradyne



". . . this is the ideal set for the man who wants a fairly large number of stations, but with quality as his chief requirement"

I CAN well remember testing the Quadradyne, a set very similar to this one with its four-gang condenser and two high-frequency stages in the early months of last year. This original Quadradyne gave really fine results and especially good quality.

The new set gives even better results, the quality is every bit as good as that given by a present-day mains set, and its general performance—sensitivity and selectivity—is almost as good as the super-het.

My tests have proved that this is the ideal set for the man who wants a fairly large number of stations but with quality as his chief requirement.

The set was tested under my usual conditions in South London on a normal 35-ft. outdoor aerial with the specified accessories: valves, loud-speaker, and batteries. Altogether there are just over forty stations on the log, not a great number in these days, but a great number when we know that every one was really worth listening to.

My first experience with the set was during the evening on the medium waveband. Just one knob to turn for tuning, and the volume control. Any child could have played with the set and got the results that I got. Station after station rolled in at good strength and quality, is the usual phrase, I believe, but it is very true of this set's performance.

At the top end of the scale particularly were the results good. That certain trio, Prague, North Regional, and Langenberg, were all free of interference, and each one gave an entertainment. And so did all the other medium stations on the log. On this waveband during daylight I easily logged all my favourite foreigners. Hilversum, a delight at breakfast time, came in remarkably well.

Long waves on this set are much better than on the original Quadradyne. All stations on the log—heard within a space of ten minutes—were worth listening to except Kootwijk, the new Dutch 50-kilowatter. Moscow has apparently taken a fancy to the wavelength and delights in ruining the reception of the Dutchman. It is the same on all sets at the moment. Kootwijk is a particularly fine signal during daylight hours: its programmes are light and cheery, too.

One peculiar point I noticed with this set was the long-wave "breakthrough" of the two local stations. Both came in together at 10 on the scale, but their overall spread was not more than two degrees. No harm was done by this.

This is one of the best battery sets that I have tested. If I can tune in over forty stations during an hour and hear nearly all of them at fine strength and fine quality, I believe that is all one can reasonably expect from this station-ridden ether of ours. This set gets the best stations and gets them well; it will not bring in the host of ether weaklings.

Quality is this set's chief recommendation.

T.

Station Log of the Class-B Quadradyne

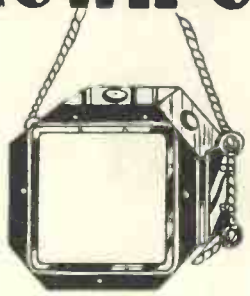
LONG WAVES

Station	Dial Reading	Station	Dial Reading
Moscow	8	Eiffel Tower	52
Oslo	18	Daventry	58
Kalundborg	24	Berlin	67
Luxembourg	28	Radio Paris	72
Motala	43	Kootwijk	83
Warsaw	47	Kaunas	91

MEDIUM WAVES

Nurnberg	0	Midland Regional	57
Trieste	7	Sottens	59
Gleiwitz	9	Athlone	61
London National	14	Moscow	64
Bari	17	Stockholm	66
Heilsberg	19	Rome	68
Scottish National	23	Common Wave	72
Hilversum	25	Beromunster	74
North National	27	Lyons	75
West Regional	30	Langenberg	78
Breslau	34	North Regional	80
Poste Parisien	35	Prague	82
Milan	36	Florence	85
Brussels No. 2	38	Brussels No. 1	88
Strasbourg	40	Vienna	90
London Regional	44	Munich	96
Scottish Regional	51	Sundsvall	98
Toulouse	53	Budapest	100
Leipzig	54		

The "Low-down" on the B.B.C!



FRED SMITH

an American, criticises the B.B.C. in provocative fashion

THE British Broadcasting Corporation gives greater value for the money and receives more criticisms on its efforts than any institution I know.

During my five months' stay—and what a pleasant sojourn!—in England I have been taken, as a guest of the B.B.C., on delightful journeys to a National Celebration in Wales, to the tennis courts of Paree, to musical festivals in Germany and Austria, and even to my own native New York City. Or rather, the B.B.C. has brought to me the best and the most charming *souvenirs* of distant lands.

On the evening of the initial Promenade concert this past season I paid fifteen shillings for two seats, plus taxi fares—at least a total of twenty shillings, the price of a wireless licence for two years! During the remaining four dozen Proms I picked whatever part of the programme I cared especially to hear and entered the auditorium of the other on a B.B.C. pass.

Not that the visual performances, even of recitals and concerts, can ever lose their prestige and attractiveness before the fascination of the radio. And not that every radio listener and every reader of this magazine doesn't know full well the truth of what I have already stated. But just to let it be known in advance that I, an American who is about to suggest certain criticisms of B.B.C. policy and programmes, am thoroughly acquainted with the virtues of the institution.

I have been amazed at the variety of criticism hurled at Broadcasting House. And in a consideration of this plethora of anathema, one must become aware, sooner or later, that the institution has survived and developed, not because of criticism, nor in spite of it, but because the B.B.C. management has had the wisdom to operate its machinery on the basis of an intelligent policy under the direction of an impersonal will to carry out that policy on the conviction that it is the best for Britain.

Through my hands and under my observation, during the past three months, has flowed a strange stream of information, news, and history. I have been making a careful study of the German-Jewish problem. My investigations and my conclusions have been of the most impartial nature. I have read and listened to both sides of the case. As one might readily expect, each side thinks itself beyond reproach—and that the other is absolutely wrong. I am about to cite a case of B.B.C. criticism, but the point I wish to make first is, that the two opposing criticisms come not particularly from Germany or from British Jews, but from points of view that see life very differently but look at the B.B.C. with the same suspicious glare.

In his book, "The Alien Menace," Lieut.-Col. A. H. Lane devotes a chapter to the B.B.C. under the title of "Aliens and the B.B.C." Herein he insinuates, and I might say that he directly declares, that the British Broadcasting Corporation gives preference to internationalists in allotting time for the expression of political ideas and cheats true patriots out of the right to similar expression. In the concluding lines of this chapter the author states: "The facts adduced and the quotations would suggest that the British Broadcasting Corporation, like its parent, the British Broadcasting Company, is being directed by Pinks or Reds."

So much for that side.

As all the world knows, Adolf Hitler and the National Socialist movement in Germany stand for principles that are anti-Red, anti-Socialist, anti-Communist. But the British Jewish contingent pounced upon a B.B.C. criticism with joy, because it accused the B.B.C. of

"From foyer to roof the atmosphere of artificiality grips you by the throat. You couldn't be natural inside that tower if you were to be shot at sunrise"

being partial to Nazi Germany. In The *Jewish Chronicle* of September 6 (page 25) a letter is reprinted after previous publication in the *Daily Telegraph*.

"As the B.B.C. relay from Leipzig about the Fair there could only be construed as a form of advertising, it would be interesting to learn whether the broadcaster received a fee, and whether he was acting on behalf of German interests. A part of the broadcast was in the nature of propaganda, it being mentioned that only a small section of the Fair was restricted to 'Aryan' exhibitors."

Thus much for that side!

Obviously the B.B.C. is in the position where "you'll be damned if you do and you'll be damned if you don't."

These are only highlights in the criticisms I have chanced upon during my stay in London. Newspaper critics are often caustic and generally justly so in their analysis of performances. In its July issue the "Wireless Magazine" published an excellent criticism by Whitaker-Wilson on the ills of and offering excellent remedies for the variety hour. The B.B.C. itself, for the first time in its history, issued an official reply to criticisms in a series of three articles published in the *Radio Times*.

The B.B.C. has its ready-to-utter reply to every criticism. These replies do not constitute infallible rebuttals and I do not see how they can placate the critics—but they do, evidently, satisfy the B.B.C.!

Before passing to the weaknesses, I think I have perceived in B.B.C. performances, let me enumerate what I consider its most praiseworthy and incomparable features:

1. The great B.B.C. orchestra and its component groups.
2. The broadcast of major musical events—Proms, Covent Garden, etc.
3. Excellent dance bands.
4. Dramas with casts including such stars as Elizabeth Bergner and Cyril Maude.
5. Pick-ups of great events outside London—British and foreign.
6. Interchange of programme with America.
7. Special stunt programmes, such as those given on Empire Day.
8. Education features.
9. First-rate speakers.
10. News.

In putting before you my criticisms I take as my hypothesis the supposition that the dominant purpose of the British Broadcasting Corporation is to give the noblest possible response to the British public's demands for entertainment and education.

In other words, I do not approach this criticism of the B.B.C. from a personal or an American point of view. There would be no point in comparing British broadcasting with U.S. broadcasting. Neither is the argument carried on under the pretence that listeners do not get their ten shillings worth per annum; for the actual entertainment value of the B.B.C. programmes is many times that amount. I maintain that the defects in the B.B.C. programme machinery are the results of un-British policies.

Whenever I come from the Continent to England my first and most pleasant impression is of British punctuality. In attending the World Economic Conference I noted that Ramsay MacDonald was always in the chairman's seat two or three minutes ahead of the appointed hour, and that his gavel fell upon the desk at the stroke of the hour. Stores and shops in London close on time, appointments are kept on time, trains run on time. The only schedule that keeps you waiting is that of the B.B.C. Sometimes programmes run over, but more frequently many minutes under the scheduled time and there you are, left to be entertained by a Peter Pan clock or an empty silence. Typical announcement at such times is the one given before the "All American Burlesque Programme" on the evening of July 25. On that occasion when the preceding programme came to a conclusion the announcer said: "The next programme will begin in about five minutes."

In the *Radio Times*'s "justification" of this negligence, the Corporation presents its case in the following manner: "The question of timing is an extremely difficult one. The dovetailing of a great number of items, in, say, an evening's programme, involves a large quantity of fine calculation, some of them depending on the personal element in the shape of individual speakers or performers, which may or may not always be under control."

And so on. But the explanation takes us nowhere and leaves us standing on the unpleasant conclusion that one of two things must be certain: Either the B.B.C. machinery is inefficient or the institution believes the public is complacently gullible. Anyone who knows anything about the mechanics of radio broadcasting *knows* that perfect timing is both possible and practical.

I have returned to London after an absence of eight years and I find that B.B.C. programme and studio policies have changed but little. Programmes are built on a bigger scale, but the quality of *studio performances* has not been specially improved. There persists the aversion to featuring announcers. They can never become stars. No matter how remarkably they report great sports events or fine musical performances, they still remain submissive cogs in the huge machine known as the institution. One is told by B.B.C. officials that the public is not interested in announcers—but one does not have to sign a testimonial declaring one believes this is so.

And too, some unfathomable mystery prevails around the legendary war between the B.B.C. and the theatres. The B.B.C. will tell you there is no war. And the theatrical managers affirm that they are perfectly willing to co-operate. But all the suffering public ever gets out of the illusive battle is the vacant fact that the two never get together. The result is, that B.B.C. dramatic productions suffer. When a *real* artist, a genuinely fine actor, is engaged to participate in a B.B.C. drama the customary cast is shown up in all its amateurishness, its self-consciousness and inability to be emotionally free.

Emotional freedom is precisely the missing quality in the soul of the B.B.C. If you don't believe it, take a look around Broadcasting House. Mechanically perfect, yes. But from foyer to roof, the atmosphere of artificiality grips you by the throat. You couldn't be natural inside that tower if you were to be shot at sunrise. Why, as you enter the portals of the edifice, when you enter this palace of the most modern art, this science of democracy depending in every respect upon its ability to administer to the masses, this ethereal symbol of progress and the twentieth century, the very first thing you see in huge letterings on the wall above the elevator doors is an eight line message *in Latin !*

If you have the courage to pass under that menace to the studios you will find your natural self gradually expiring in the mass of artificial efforts to make you—or rather, the performers—feel natural. If you are to give a serious talk, you are ushered into a studio the walls of which are lined with books—no, I beg pardon : with " stage " books, those that have only mock backs of wood—nothing in them, nor upon the shelves—that is, nothing but artificial atmosphere. In this room you are supposed to feel sober, serious, and *natural !* If your talk is on a lighter subject you are taken to the " gay " room.

The genius who created the B.B.C. tower and studios—and many of the studios are admirable beyond compare—may have been an engineer but he was *not* an artist.

I must admit that in certain respects I have been disappointed in B.B.C. programmes. In one, very definitely, I have been *shocked*. Not on a basis of prudery. Don't misunderstand. I had been living a year in Paris, and seeing its shows, just before coming to London. I am about to speak of B.B.C. burlesques. Don't rush on to the conclusion I have been hypersensitive to what I might misinterpret as their vulgarity. Oh dear no ! The quality in the B.B.C. burlesques that has given me a shock is their *bad taste*.

I listened to several that puzzled me. I could not believe that I was listening to such suggestive *double entendre*. I seemed vaguely to recognise certain old stage jokes worked over—though not polished over—for broadcasting. Could it be possible, I asked myself, that B.B.C. burlesques are giving us jokes whose humour lies chiefly in the second meaning—and a very vulgar meaning at that? Finally, I set the dialogue down on paper. On an evening in August I listened to the burlesque, a lower than which I had never heard—not even on the stage of the Cafe Conciertos in Spain.

It wasn't naughty. Just vulgar and bad taste. In one scene, two—very self-conscious—radio actors are supposed to be rehearsing a dramatic bit in a studio. While they are getting on with their parts two mechanics invade the studio to repair the piano. The mechanics get down beneath the instrument and hammer away—and talk away. They talk about " her legs " and a great deal more in a patter that dovetails into the rehearsing dialogue.

Figure it out for yourself. If this be high-class showmanship and good taste then I have been mightily misinformed with regard to requirements and manners in a London that has seemed to me in all other respects so formal and so dignified.

In truth, the gravest criticism that one might level at the B.B.C. studio performances is that they lack showmanship.

The British Broadcasting Corporation is a magnificent institution. It gives the listener fifty—a hundred—times his money's worth. Its principal weaknesses—it seems to me—lie within studio performance policies. Here are some of those weaknesses :

1. Repression of staff stars.
2. Vulgarity in variety and burlesque.
3. Vocal solos with piano accompaniment.
4. Self-consciousness on part of performers and actors.
5. The awful, awful empty spaces —waits.
6. Unpreparedness in case of breakdown.
7. Often, after concertos, distant pick-ups, important speeches and musical programmes absolutely no explanation given of what has been going on.
8. Atmosphere that is artificial instead of being genuine.
9. General inability to discover new talent and built-up radio stars.
10. The evasive war with the theatres—whatever it is—that cheats the public out of a greater variety of actors.

Aside from the above, I think the B.B.C. is grand and I hope that by the time I return again it will be collecting licence fees not from five but from ten million happy and contented set owners !

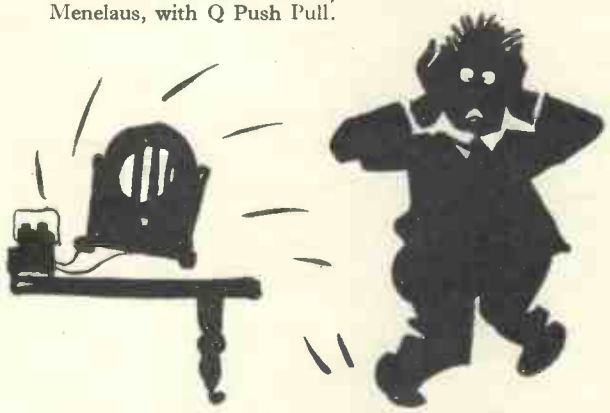
". . . the customary cast is shown up in all its amateurishness, its self-consciousness and inability to be emotionally free." At least, that's what Fred Smith says !

STUFF & NONSENSE

By "Fishglue"

THIS year has proved the birthday of all portable sets, due to some new and dinky little twists in their old circuits, so let's begin with a poem entitled, "Don't throw the set at father—wait till we get class B."

I am the good Fairy of the season 33,
And if you want to know "Sez which"
I'll tell the world, "Sez me"!!
Me and my Fairy sisters
(Whose English is worse than mine)
Will bring you Elfin music,
All "airy-like"—divine—
Strains such as Trojan Helen
Heard 'mid the battle's lull,
While Paris, he
Did his stuff with Class B;
Menelaus, with Q Push Pull.



"Sounds as beastly as a mains set"

I'm exquisitely slender and delicately slim;
My modern appetite is small,
My battery is thin.
I give no more Z quality,
No longer Turner's foil,
'Cos I've now got Class-B output,
And I work a moving coil.

If the intelligentissima will pardon me, I'll explain, for the benefit of those who haven't been reading their "W.M.'s," the exact meaning, function, purpose and object of class B and Q.P.P. amplification.

I don't expect you'll be able to follow me, but I have to write this sort of stuff to impress Ed., and to prevent Bros. James and Reyner "getting too well in."

The whole idea of Q.P.P. is to arrive at some method by which a battery set can be made to sound as beastly as a mains set, so that those who are not on the mains may have the same opportunities of making themselves miserable as those who are.

For example:—

There was a young fellow called Howell,
Whose mains set would yowel and growel:
To his battery set he
Thought he'd fit Q.P.P.,
And now that's every bit quite as fowel.

One of the objects is to lower the rate of consumption (battery, of course, not galloping). According to Lenz's Law, any body in a state of motion—well, in any case, as I say, the wattage must remain constant, whether it does or not, and that being so, if we take the root mean square, push with the means and shove with the squares, that gives us a milliampere in and a milliampere out, and one away, the biasing being such that only a small minimum current flows in any case, unless a signal is applied to the grids (accidentally, of course), in which event big noise, big amp.; little noise, little amp., and ad lib, pro rata.

This is to encourage people to run their sets more quietly, and on less volume, so making use of the increased undistorted output which uses the current the idea it is to save. It's all very, very complicated and please don't ask questions—there's a professional on the staff for that; Uncle's only an amateur.

Now, there's a subtle difference between that and class B. (No, that's what I thought when I first heard one, but it really doesn't mean that at all.) In this case, no bias is used—you understand, no bias or matching of valves. This is very subtle!!

In the last stage is a class-B big valve which is drave or drove by a driver valve, driving a driver transfo. mer or something like that, and the odds are about four to one, including the field. The big valve has two little valves inside, always drawn arm in arm around a common filament.

This is undoubtedly a triumph of modern engineering and costs about forty bob to instal, ninepence on the

Uncle's latest baby"

bottle, and two and six a month when you catch me. Take my tip—don't use either—I don't like them, and even if they were nice I shouldn't like them.

Incidentally, Uncle's latest baby is a nice big amplif., with a really honest bottle called DO24, in the dickey seat. Her real name's Doris, by the way!! She amplifs. beautifully sometimes.

"Pay a quid"

In the latter event she's more on her plate than she can chew, and the excess is eschewed and in the ensuing distortion the meter "gives it the needle." (Horrible!!! —Ed.)

The other evening, after a lobster supper and reading about "The Show," I fell asleep whilst musing on the buying of a new set. The ensuing nightmare I utilised to produce the following, to be sung with expression to the well-known tune of "Mountains of Mourne." I offer this with sincere apologies to "Mrs. Thomas's Favourite Husband." Don't read this, please sing it—it sounds worse!! Tighten your couplings and join in—

When I married the missus, I took a nice flat—
Hot, cold and electric, the other and that.
Each evening we'd spend round the fire after tea;
The Missus, her mother, the bulldog and me.
No 'gram, no piano, no wireless, no nowt;
We decided at last we could not do without
A nice little set—say, just two valves or three—
For the missus, her mother, the bulldog and me.

So off we all went to the shop in the town.
I'd soon told the chappie for what I'd come down:
"We want a nice wireless," I said, "do you see,
To cheer up the missus, the bulldog and me."
He showed us a curly band-pass super-het,
And said it was sure just the cutest thing yet:
"There isn't a set that can touch it," said he,
And he'd soon "touched" the missus, the bulldog and me.

He said, "Pay a kvid and you have it at vunth,
Then Issy'll come round for der ten bob a month."
I grinned at the missus, she said she'd agree;
O.K. with the bulldog, her mother and me.
We hurried it home just to get it fixed up,
The bulldog ahead, with his flat nose turned up,
The roll of his guard's van made patent to see
He was proud as the missus, her mother and me.

We connected it up to the aerial above.
"Get on," says the missus. "Let's hear it push shove."
So I twiddled the knobbly bits. Bursting with glee
Was the missus, her mother, the bulldog and me.
We tuned in to Paris and Berlin and Rome.
(We tuned in to Mars, but he wasn't at home.)
The poor bulldog's dial was piteous to see.
"Wot's up?" says the missus, her mother and me.

We carried him out in the air for a while
'Cos the poor beast he couldn't stand Elsie Carlisle;
And in less than five minutes we'd followed, all three—
The missus, her mother and finally me.
"I've never heard such a darned moan in my life,
She must be in pain, dear!!" says my father's wife.
"But she can't have a pain worse than wot she gave me."
"Ere!! Ere!!" growled the bulldog. "I'll say so!!" sez me.

The set still glares down from the mantel above,
With a dial that only a mother could love.
We don't have it on now in case she should be
Moaning again at the bulldog and me.
The missus, she curses the poor blighted set;
The bulldog goes daft if you say, "super-het."
We've finished, we've all had our lesson, you see—
The missus, her mother, the bulldog and me.

Very, very sad, but founded on fact. By the way, I heard a rumour the other day to the effect that the lady mentioned in the "pome" had had her adenoids removed. This is quite untrue, as I can assure you she is still "*singing*" up (or down) to her usual standard.

Still, I suppose crooning is like castor oil—there *are* people who like it. I think myself that Mr. Whitaker-Wilson has a soft spot for it somewhere.

That, by the way, I trust you will consider as being strictly *entre nous*.

I wonder what would happen if someone in a dance band were to really *sing* a song? W.-W. would probably get Ed. to rush a special edition of "W.M." into print. The same issue would inform the literary world that Uncle Fishglue had died from heart failure.

Mind you, literary people must admit that even if they don't approve of the execution (song, of course, not crooner) they must admire the lyrics. Don't you

"By all the blinking stars"

think the occasional Gilbertian touch is rather hot? What about, *per exemple*—

"When winds are stormy
Your arms will wormy" (warm me)?

Just let's take a few rhymes whilst nobody is looking and scrounge a few ideas from the old folks (Plagiarism is *à la mode* in music, so why not in lyrics?). What's sauce for the goose is indubitably gravy for the duck, as I think Ibsen, or someone equally perverted, said.

"By all the blinking stars above you
(That rhymes O.K. with 'How I love you'),"
She shyly murmured "We are seven,
And I'm eleven pounds of heaven."
Wordsworth's sweet lass, Lucy Gray,
Rhymes with Minnie's wedding day.

Have you heard that pathetic little ditty entitled, "When mother played the organ and daddy sang a hymn?" It's really good—ask Whitaker. The best

suggestion that I can make to the writer is that he takes a subsequent hint and goes "down in the old oaken bucket."

A pal of my brother's, who by sheer hard work has risen from an ordinary lunatic to the governor of his own asylum, tells me that he can't get enough respectable lunatics nowadays to keep going—they're all drawing good salaries now arranging bad words to fit or misfit worse music. What does the Prophet say?

> For there shall be rows, and rumours of rows, and behold, it shall come to pass, that they shall not always be rumours. For Ham, son of Brose, shall call together unto him his young men, and shall say unto them, "Make ye the people joyful, in that ye make sweet music upon the Lute, the Bone, which is called Trom, and the Fone, which is called Sax, and, moreover, smite ye the Timp

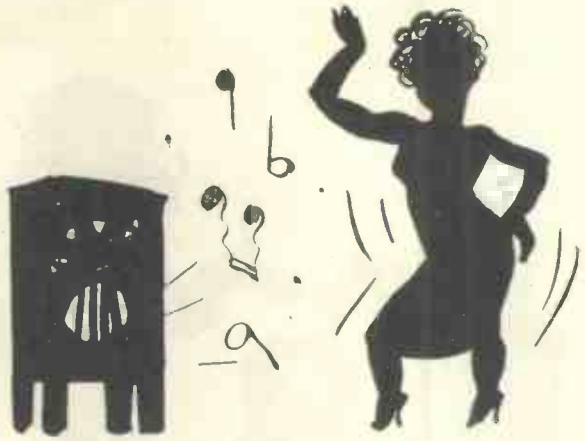
"Arranging bad words"

> and the Sim Bal, so that there shall be much Ri Thum, yea, even until the number thereof is Hot."
>
> And when they have done, he shall speak unto them, saying, "That noise which ye have made unto me, name ye that Mu Sic?" And when they answering shall say, "Yeah Ham," he shall weep, and say unto them, "Then are yea all Li Ers, and the colour thereof, it is Blu. And the Maiden, which we have taken unto us, in that she hath told us that she lifteth up her voice in song, she hath deceived us, and she too is even one of you. The Mu Sic which is called Prom, is even as the flesh pots of Egypt, and our souls pine for it."
>
> Lo, it shall come to pass that the voice of the people shall be lifted up against their ruler, the Pharaoh men call Pee Emgee, because he hath made their stomachs to be sick on the Holy Days. For he hath said unto the players of sacred Mu Sic, "Ye shall play," and unto the Scribes and Elders, "Ye shall preach," and unto them which ask for alms, "Ye shall ask."
>
> But unto those which would play joyful Mu Sic upon the Kan and the Tabor, so that the young men and the maidens should dance, he hath said, "Ye shall not play." And unto the jester which would make sacred jests, he sayeth, "No." And unto all Vor-der-vill, yea, even sacred Vor-der-vill, he hath said "No."
>
> Against all these things hath he hardened his heart, and he, having eyes, sees not, and having ears, hears not, and the young men and maidens cry out against him, and give their ears unto the sons of Par Is, from afar, and hearken unto the voice of Fe-Kahmp, on lower Me Ters.
>
> Woe unto him, and even also Gee Up, for he shall be like unto the wife of Lot, and Doctor Crippen.

But blow the prophet, this isn't his article, and he'll be coming along wanting his share of the proceeds.

I've nothing to say about Olympia—not a word. When I realise that I can make anybody a good straight three for £5, and then look at Olympia prices, I get completely "hooey." When I think of seven-stage super-hets, A.V.C., using variable-mu's in front and class-B outputs with loud-speaker, valves and cabinets, all for about 14 guineas—then—well, can you wonder I've nothing to say?

All I can do is to go to the junk box and get out a variable condenser, the size of a two-pound jam jar



"If your girl goes wrong"

and which isn't fit to tune a barrel organ, and remember that it cost two pounds ten!! Please let's change the subject—

> "I can't remember."—that's all bunk!!
> I wish I could forget!!!
> For what my first one-valve set cost
> Now buys a super-het!!!!

Just paste these little Euclidian theorems in your reference book, will you? Start a fresh page, please.

Theorem I.

The expenditure and income of the B.B.C. will not meet, no matter how far produced at either end.

Theorem II.

If P be an upright pole, and W be a wire meeting P at any angle, and S_1 be the sum, then, if P and W be external, $S_1 = 10$ shillings per annum. If P vanishes, and W be arranged in the form of a square, and is internal, then S_1 becomes equal to O.

Corollary.

The view taken by the Authority will always be at a different angle, and the alternative to imprisonment will be such that S_2 will increase and approach L (S_2 = sum payable on S becoming equal to nothing).

Theorem III.

If, in any given speaker, the increase of base, and the increase of treble, be parallel, then the angle of the cone shall be the right angle.

In conclusion, I should like to be allowed to deal with my correspondents.

Daring and Dimpled.—No, I really can't answer your last letter in these columns. You can't marry me, 'cos I'm the best husband my wife has got, but you can listen in to the same love-songs as me, under the same moon, and that'll be nice, won't it? Don't write me any more letters, will you, 'cos Ed. doesn't like it.

W. Dogsboddy, Little Muggam.—The station you heard was probably not working. The two tunes you mention, "The Jewel Song," from Tanner Houser, by Woolworth, and "I knew she was fly, as soon as I spider," in all probability came from somewhere else, unless they were off that wavelength altogether, in which case Jay Coote won't know either. I shouldn't bother, if I were you.

Worried Mother, Wigan.—If your girl goes wrong, I should blame Henry Hall—he *will* play them love songs when they should be in bed. Yes, I agree with you, that saxophone isn't nice; it sounds more like passion to me, than love. Try and get her to broaden her mind with wholesome ideas, put her to bed early, and make her read *The Listener*.

And so, for the present, I leave you.

"Fishglue."

RADIO AND THE POLICE

By
L. A. CHAPMAN

An interesting article describing the latest radio methods adopted by the police for mobile patrols and the Flying Squad

(Above) A radio set in use in one of the police vans during an unemployed demonstration, and (right) one of the Brighton mobile police squad working a motorcycle portable radio set

WHENEVER you read in your daily paper an account of a thrilling encounter between members of the Flying Squad and motor car bandits, you may be certain that radio played an important part in the affair.

It is not often that one reads of the actual part played by radio in these affairs, the information usually being suppressed for obvious reasons. Readers of "Wireless Magazine," however, are wireless fans, and will be interested to know how radio helps the police in the capture of bandits.

Perhaps the first occasion upon which radio assisted the police in the capture of a criminal was that in connection with the arrest of Dr. Crippen, on board the liner *Montrose* in mid-Atlantic. From that day radio has assisted the police in the detention of many suspected aliens and dangerous criminals, not only in English, but in American and most towns and sea-ports throughout the world. Although the earlier police reports which led to such detentions were transmitted through ordinary commercial channels, most of the present-day radio activities are conducted through "pukka" police radio communication networks.

That controlled by the Metropolitan Police at New Scotland Yard is, without doubt, the most elaborate one controlled by any police force in this country. Some idea of its extent may be gathered from the following :—

In September, 1932, many radical changes were proposed by Government departments in regard to the methods of communication used by the police. The upshot of these proposals was that the Home Office ordered exacting tests to be conducted at the police training grounds at Imber Court.

The result of the tests was that the police and Flying Squad of London were to use morse-code telegraphy, as opposed to the alternative system of telephony, for all communications connected with their work.

Certain sections of the County Constabulary, however, prefer telephony, and use it to this day. Pocket wireless telephony receivers of the type suited to police use are always undergoing tests. The Brighton police use them very effectively.

There are many reasons opposing the use of telephony communication in the London area, the most important, perhaps, being the limited range of a telephony transmitter as compared with an equal power morse transmitter.

In addition to the Imber Court tests proving so conclusively that morse telegraphy was the most satisfactory radio system for the London police to adopt, they also brought home to those in authority the fact that the then existing transmitter at New Scotland Yard was altogether antiquated for the work it had to do. Various proposals were made with a view to remedying this, and the final plan eventually adopted resulted in the erection of a number of relay transmitting stations at strategic points in the London area.

This, on its own, was a very

commendable step in the right direction, but the final touch (added by the police themselves) made the system completely infallible. It was arranged that each of the relay station's transmissions should be operated and controlled simultaneously by the operator on duty at the main transmitter at New Scotland Yard.

Having increased their effective radius of radio communication, the authorities looked around themselves for a more effective means of combating the car-bandits' speed.

It did not take them long to realise that with all their radio-equipped Flying Squad tenders bottled up on the Thames Embankment, the bandits had things all their own way for making speedy tracks out of London.

They therefore re-organised the Flying Squad and stationed a large number of tenders in outlying districts.

This proved to be a very astute move, for, whenever a bandit raid report was "broadcast" to the outlying tenders, they were able to converge on the area of activity and so bottle up the bandit.

During the early days of this new scheme of things, many bandits were actually caught in their cars with the "goods on them."

After they had learned of the Yard's new move, however, the bandits took to abandoning their cars near the scene of their crime and attempting to lose themselves in London's crowds.

This move, also, was forestalled by those at New Scotland Yard. Realising that the bandit had lost his great advantage of speed, the authorities decided that their own Flying Squad cars did not require to possess this feature.

They therefore turned to subterfuge! Perfectly standard makes of saloon car were acquired for use by the Squad. Besides being cheaper and enabling greater numbers of cars to be purchased for the same original expenditure, the new cars were admirably suited to their new purpose.

In the rear of the new saloons, accommodation is arranged for a radio operator with his apparatus, and seating for a couple of detectives.

You might think that when the cars were out on the road, their object would be patent to passers-by. Not so, however, for their rear windows have special curtains which allow the "passengers" to see out but do not allow pedestrians to see in.

As regards the wireless set carried, this does not differ greatly from any used by the ordinary amateur. Straight-circuit sets are most popular because they do not accentuate the difficulty of eliminating noises in reception due to the coils of passing motor-vehicles. Troubles of this kind due to their own cars are prevented at the source by having resistances fitted to their spark-plug leads, and chokes and condensers to the supply lead to the contact breaker.

Most of the receivers used are completely screened, only the aerial is unscreened, this being erected in the roof of the car. The car chassis forms the earth of the receiver.

Loud-speakers are taboo for obvious reasons, so the operator has to wear a pair of headphones clamped tightly about his ears when on duty.

The messages he receives, in addition to being transmitted in morse code, are also translated into secret codes to disguise their meaning. It would be useless, therefore, for a bandit to attempt intercepting police messages because months of experimenting would be necessary to learn the wavelengths used, let alone discover the key to the codes.

Finally, the messages would be of little use to him unless he knew every police car on the road. This, obviously, is an impossibility, for in external appearance there is nothing to show the difference between a Flying Squad car and one owned by "Brown" or "Smith." Inside, of course, there is a different tale to tell as has already been learned.

(Left) A short-wave transmitter used by the French Surete and (above) a demonstration of police radio being carried out by officials of the Brighton police force

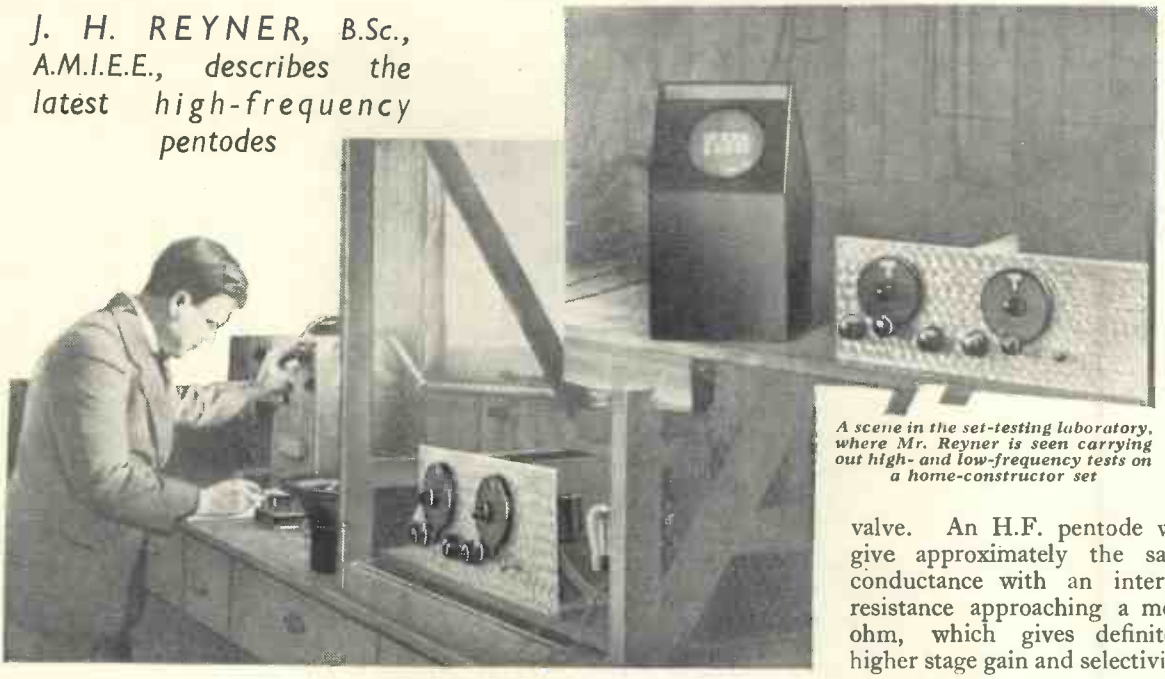
Now, if a bandit dispenses with his car after he has made a raid, it does him no good. A general description of his appearance is sent out and is in the hands of those who are out to catch him. Inside the car "sparks" hands out each item of report to his colleagues whilst they, in turn, keep their eyes on every passer-by.

Suddenly the car stops. Out jump two very able detectives, and one more "fly-by-car" is safe in the arms of the law.

No one is more surprised than the bandit. He may wonder how the police singled him out from among so many of London's millions. He may never learn, but the authorities do their best to give him plenty of "time" to think things over!

All About the Screened Pentode

J. H. REYNER, B.Sc., A.M.I.E.E., describes the latest high-frequency pentodes



A scene in the set-testing laboratory, where Mr. Reyner is seen carrying out high- and low-frequency tests on a home-constructor set

THE screened pentode is a form of pentode valve specially developed for high-frequency amplification. Before we discuss the best methods of using it, it will be interesting to discuss why such a valve should be considered desirable at all, and we will begin by reviewing how a high-frequency valve works.

The screen-grid valve contains the usual filament, grid and anode, and, in addition, a screen of gauze between the grid and the anode. The purpose of this screen is twofold. It reduces the capacity between anode and control grid to a small amount.

Reaction Effect

In a high-frequency amplifier using ordinary valves a reaction effect which takes place through capacity between anode and grid, and the amplifier quickly becomes unstable. The circuit oscillates continuously so that the set behaves as if it had a reaction control permanently adjusted beyond the oscillation point.

The screen between anode and grid in the ordinary tetrode or screen-grid valve reduces the capacity to such a small amount that this reaction effect disappears under practical conditions. The second advantage of the screen is that it enables the goodness or mutual conductance of the valve to be maintained when the amplification factor and internal resistance are increased.

The amplification factor is increased by using a close-mesh control grid in which the wires are close together, but this tends to act as a screen on its own and prevents the electrons emitted by the filament from getting across to the anode. By placing a positive potential on the screen proper (which is just outside the control grid) we supply an additional attraction to the electrons so that the valve is able to work properly.

The high-frequency pentode carries these processes a little farther. The usefulness of a high-frequency valve can be measured in terms of the expression $g\sqrt{R}$ where "g" is the mutual conductance or goodness factor of the valve and "R" is the internal A.C. resistance. Assuming that we can keep the mutual conductance the same then it is obvious that the higher we can make the internal resistance of the valve the better the performance. Unfortunately, the increase in internal resistance is usually accompanied by a falling off in the conductance and the usual screen-grid valve compromises at a resistance of the order of 200,000 to 300,000 ohms with a mutual conductance of about 3 for a mains valve and about half this for a battery valve. An H.F. pentode will give approximately the same conductance with an internal resistance approaching a megohm, which gives definitely higher stage gain and selectivity.

Pentode Construction

The construction of a screened pentode is similar to that of a screen-grid valve, the main difference being the introduction of an extra grid between the screen and the anode. This grid, which is known as the suppressor grid, is usually connected to cathode, but in some cases is brought out separately so that it may be used for other purposes. The introduction of this suppressor grid has two important effects. It enables the internal resistance of the valve to be made higher for the same mutual conductance which, of course, is the object we are aiming at, and secondly it avoids what is called the *negative resistance* portion of the characteristic.

Electrons Bounce !

If the voltage on the anode of an S.G. valve is less than that on the screen the electrons which reach the anode bounce off again and return to the screen. The anode current, instead of increasing as the anode voltage is increased, actually decreases. It is just the opposite to what happens in an ordinary resistance and it is therefore termed the negative resistance effect.

In any ordinary circuit the currents are gradually damped out by the resistance in the circuit. If the resistance is negative the currents

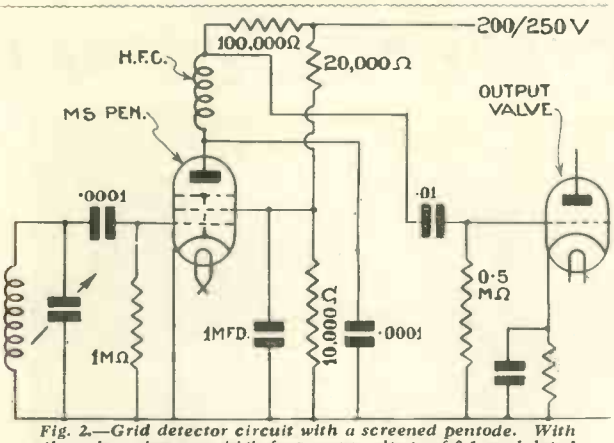


Fig. 2.—Grid detector circuit with a screened pentode. With the values shown an high-frequency voltage of 0.1 modulated 30 per cent. will develop 3 volts across the anode resistance. The valve will handle a signal of 0.5 volts without overloading

will not die away but will increase. Consequently, a circuit connected to a screen-grid valve operating in the manner just described will oscillate continuously and the whole set will be unstable.

Provided we can use a high anode voltage this does not trouble us because the voltage change in the anode circuit is quite small and under working conditions the anode voltage never falls below that of the screen. For low-frequency amplification this condition does not apply and screen-grid valves cannot be used satisfactorily. The ordinary output pentode was developed to overcome this negative resistance trouble by introducing a suppressor grid between screen and anode and this prevents the electrons which reach the anode from bouncing off again. The same principle is applied in the screened pentode with the important difference that in the H.F. or screened pentode every precaution is taken to avoid internal capacity between anode and control grid.

Pentode Characteristics

Those readers who like curves will appreciate the characteristic shown in Fig. 1, which shows the variation of anode current as the anode voltage is increased for a screened pentode and a normal screen-grid valve. It will be seen that with the pentode the negative resistance effect is completely removed so that the valve can handle a very much larger anode swing without any danger of distortion or instability while also the top portion of the curve is appreciably more horizontal, indicating a higher internal resistance.

The screened pentode is used in exactly the same manner as the screen-grid valve. It is put out with a five-pin base of which the connections are exactly similar to the ordinary valve, the anode pin at the bottom being connected to the screen which should have about 100 volts on it, and the anode being taken to the top cap. The replacement of a normal screen-grid valve by a pentode will give better amplification, better stability and better selectivity owing to the higher internal resistance of the valve, which minimises the damping effect of the valve on the tuned circuit.

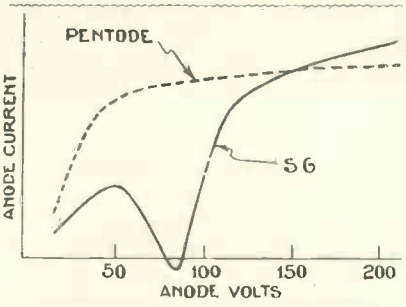


Fig. 1.—Variation of anode current as the anode voltage is increased, for a screened pentode and a normal screen-grid valve

In fact, with the ordinary small coils in use to-day, valve damping with a screened pentode is negligible.

It is interesting to take a practical example showing the improvement in amplification. Suppose we have two valves — one a screen-grid and the other a screened pentode — each having a mutual conductance of 2.5, but the screen-grid having an internal resistance of 200,000 ohms and the pentode 800,000 ohms. With a simple tuned-anode circuit having a dynamic resistance of 50,000 ohms, the amplification with the screen-grid valve would be 100 and with the screened pentode 118, an increase of 18 per cent. without altering anything in the circuit.

This improvement, however, becomes more marked as we improve the performance of the coils. If we consider a tuned circuit having a dynamic resistance of 200,000 ohms (and this is quite possible at the intermediate frequencies used in superhet amplifiers) we obtain with the same two valves amplifications of 250 and 400 respectively, the pentode here being 60 per cent. better!

It would seem, therefore, that there is a need for more efficient tuning circuits to make the best use of these new valves. An amplification of 500 or 600 per stage is quite possible with the new screened pentode at intermediate frequencies. The self-capacity of the valve is such that very much higher amplification than this could be obtained but the stray capacities in the circuit and other sources of feedback would cause trouble long before the theoretical maximum value was reached.

Pentode Detectors

There are numerous other small advantages arising from the screened pentode. One particular application is that of the valve as a detector, either in the frequency-changing circuit of a superhet or as a normal speech detector. Due to the absence of the negative resistance characteristic the valve can be used to handle quite large voltage swings and it makes a very satisfactory detector valve. The screen voltage can be somewhat reduced to about 60 for this purpose, but it is not critical.

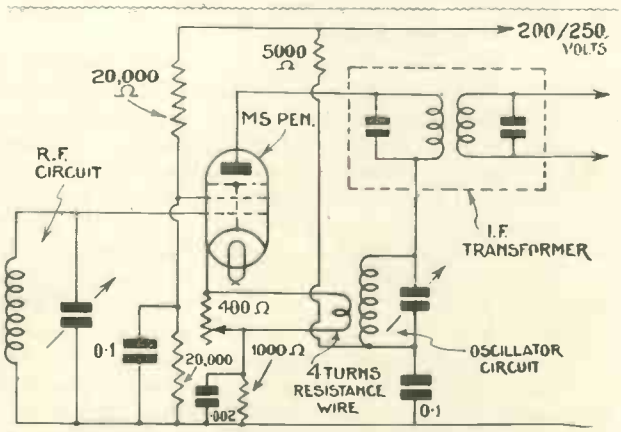


Fig. 3.—Frequency changer circuit. The oscillator coil should be efficient and the reaction coupling as small as possible. The bias resistance and condenser in the cathode lead may be varied slightly but should not depart much from the values given. The 400-ohm resistance across the reaction coil is for the purpose of controlling the oscillation

Measuring Noise

The right-hand photograph shows the acoustic meter developed by Standard Telephones and Cables, Ltd.

THE measurement of the intensity of noise is of considerable interest to set users who carry out serious testing.

Typical of the latest systems of noise measuring is the acoustic meter developed by Standard Telephones & Cables, Ltd. This is described in a Standard engineering bulletin, from which the following information has been obtained. It is a small portable instrument designed to measure acoustic noise in the most simple manner possible. It operates over a wide range of noise intensities so that it can be used for the measurement of sounds at low levels, such as the hum associated with power transformers or for loud noises produced by heavy machinery and aircraft engines.

The set makes use of the "Offset receiver" method of measurement, in which the observer listens simultaneously to the noise under observation and to a standard reference noise in a headphone receiver which is held a fixed distance from his ear. The measurement consists in adjusting the intensity of the standard noise, which is generated in the set, by means of a calibrated volume control until it is just not masked by the observed noise, the observer having only to find the threshold point without being called upon to estimate equal intensities. In order to enable measurements to be made of observed noise over the whole audio frequency range, the standard noise is also arranged to have frequency components over the whole frequency range. An equalising network is also incorporated which takes into account the individual response characteristics of the average telephone receiver, of the type used, and the frequency distribution of the energy of the standard noise. All frequency components of the standard noise consequently appear simultaneously above the threshold of hearing within relatively small limits.

The clockwork motor is first of all wound up, the battery switch turned on, and the rheostat adjusted until the meter reads a predetermined current. The "Offset" receiver is then placed on the head and the attenuator dial and switches adjusted until the noise under measurement just fails to mask the standard noise heard in the telephones.

The reading obtained is a direct measure of the intensity of the observed noise in terms of the latter's masking effect, and relative changes of intensity can be quickly and easily followed over a wide range. Where measurements of observed noise are required in terms of the level above threshold, a chart is provided which converts the meter readings to the equivalent sensation levels, and as it is convenient to express the measurements in terms of the equivalent loudness of an 800 per seconds tone, the chart is arranged to take this into account.

The instrument is contained in an oak case fitted with a shoulder strap or carrying handle and measuring 9 in. by 6½ in. by 7¾ in.

The standard noise is produced by a silent-running clockwork-driven commutator which normally runs for 5-6 minutes on one wind, thus avoiding the use of a buzzer or other noisy device which would render measurements of faint sounds inaccurate or impossible. The panel carries a battery switch, rheostat and milliammeter, a 0-30 decibels attenuator dial having 2-decibels steps, and two switches, each adding 20 decibels to extend the range. The inductance and condensers forming the equalising network are located underneath the panel, and a space is provided for the headphone receiver and headband. The unit is easily withdrawn from the case for inspection. The drain is only 5 milliamperes, and consequently replacement is seldom required.

The accuracy of measurement depends on the conditions under which the observations are made, and to a certain extent on the kind of noise and its uniformity, but results may be expected to agree well over the whole range of intensities and for all normal observers.

The smallest step (2 decibels) on the variable attentuator represents the minimum change in level which can normally be detected by the human ear and consequently results cannot be obtained to a greater accuracy than this.

"RELAYED FROM SADLER'S WELLS . . ."

"RELAYED from Sadler's Wells . . ." is likely to become just as familiar a phrase as was the announcement of relaying from Covent Garden in the early days of broadcasting.

The B.B.C. has installed special microphone-control apparatus at the famous Sadler's Wells Theatre, and in many respects this is an advance on the apparatus installed in Covent Garden. On September 19, the first relay was made from Sadler's Wells, and this was the first of a new series of opera broadcasts, being on that occasion Acts 1 and 2 of *La Boheme*, conducted by Albert Coates.

There are six microphones at Sadler's Wells, three being in the footlights, and three on the orchestral rail. Two of the orchestral rail microphones are on rods which rise 12 ft. high. An ingenious system of indicator lights has been fitted up.

The man at the balance and control panel is beneath the stage and so cannot see the artists, but the indicator light panel, controlled by a man in the wings, enables the microphone operator to follow the leading actors and actresses and to pick out the solo parts. Green, red, and white lights are used to indicate the action of the play and positions of the artists. This is the first time that such an indicator light arrangement has been used by the B.B.C., and it is one of the signs that the Sadler's Wells broadcasts will become popular by reason of their technical excellence, as well as of their inherent interest.

Sadler's Wells history is interesting. It was during the reign of Charles the second, that a Mr. Sadler discovered some wells on the site where he had established a house of entertainment, thus its name arose, and from that day until the present time a theatre has always stood upon that spot.

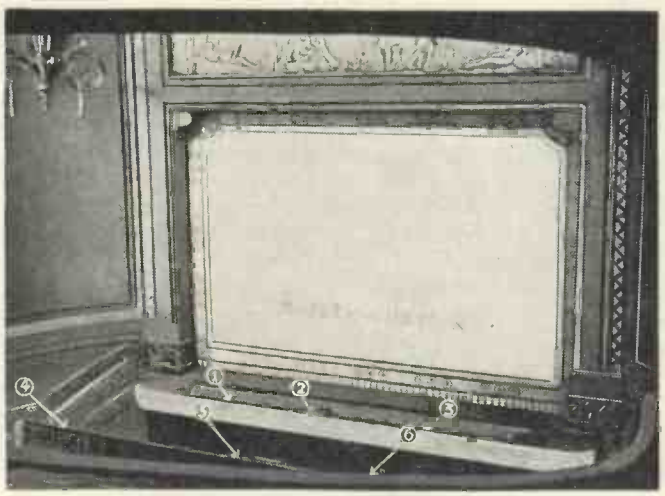
Many celebrated names have been associated with it in the past, among which Charles Dibdin, Grimaldi, Edmund Kean, and Samuel Phelps are the most illustrious.

For many years it was in a derelict and dilapidated condition until in 1924, when Lilian Baylis had the idea of reopening the historic house. With Mr. R. P. P. Rowe's (a member of the Old Vic's Governing body) invaluable help, the sum of over £70,000 was collected (this includes very material assistance generously afforded by the Carnegie Trust Fund) and on January 6, 1931, the entirely re-constructed theatre was open.

Of the original building scarcely anything remains but a part of the old wall on the north side, and at the back of the pit (but boarded over) there is one of the wells.

Many influential and well-known people, under the presidency of Viscount Hambleden, have formed themselves into a society which is called "The Friends of Sadler's Wells," and through their generosity and efforts, various amounts have been raised which have enabled Miss Baylis to add operas and ballets to the repertory, to give handsomer settings to some of the Shakespearean productions, and to pay for more orchestral rehearsals from time to time.

The theatre now, as it stands, can bear comparison with any of the West End houses—true, its decorations are severely simple, but it possesses a majesty of its own, and every seat commands an uninterrupted view of the stage as there are no pillars or columns.



MICROPHONES AT SADLER'S WELLS

The microphones 1, 2 and 3 are on the footlights, while 4 and 6 indicate the positions of the two microphones supported by rising rods. The control room is beneath the stage

How the Expert Gets Things Right

By W. JAMES

THERE is a right and a wrong way of doing most things. When experimenting with receivers you will find that results are often obtained even though a few things have been carried out in the wrong way. But the squeaks and howls, the bad quality, the instability, and the generally "difficult" tuning all point to the fact that things are not as they should be.

Now, as readers of this paper you will be used to seeing diagrams of how sets should be wired. I am, therefore, giving below a diagram of a simple set wired with numerous mistakes; wired, in fact, as someone inexperienced might carry out the work.

Circuit Difficulties

A set wired according to the sketch would certainly give results if it were supplied from decent batteries. But there would be various difficulties.

You will notice, in the first place, that I have wired the aerial-grid circuit tuning condenser the wrong way round. Instead of connecting the *moving* vanes to earth I have taken them to the grid. The result of this simple reversal of the two wires to the tuning condenser is that *hand effects* may well be very troublesome.

This is more likely to be noticed on the lower wavelengths. When the hand is placed on the knob of the condenser for tuning, the hand is actually being placed near the grid of the valve. The capacity effect of the body to earth is, therefore, bound to be noticed.

Hand Capacity

Normally, as the hand is placed near the knob the capacity of the circuit is increased. Therefore, if the station is carefully tuned in, it may vanish when the hand is withdrawn, as capacity is also taken away from the circuit.

A few years ago there used to be any amount of trouble with hand effects. We used to fit long handles to the knobs of the tuning condensers partly, it is true, in order that a slow motion effect might be obtained, but chiefly so that the hand should be well away from the tuning condenser when adjusting it.

You should, therefore, always connect the moving vanes to the earth side of a circuit. This might mean the low-tension negative, positive, grid bias, or earth. These points have a fixed potential, and are thus *safe* points to which moving vanes may be connected.

Modern condensers are usually so constructed that a slow-motion dial may be fitted to them, and it is important that the mass of metal in the slow motion mechanism be "earthed."

The next point in the diagram is the screen of the screen-grid valve. I have shown this connected to the high tension. This means that the screen of the valve will have the voltage of the tap on the battery, but it might have a varying voltage as well. For suppose the battery is of high resistance. Then the voltage may vary a little according to the current flowing through the power valve.

This might be serious or not; it depends upon the state of the battery and the circuit in general. Possibly the effect of high-frequency variations, brought about by the normal action of the valve, might be more serious. I have known some sets that seemed to work fairly well with only the connection to the battery, but in nearly every case the results are much improved by joining a fixed condenser of fairly large capacity, such as .1 microfarad or more, between the screen of the valve and the negative side of the filament circuit.

This condenser acts as a low resistance path for varying or high-frequency currents. The voltage of the screen is, therefore, held at a steady value and the best results are obtained.

I have drawn the anode circuit choke, the coupling condenser, and the tuned grid circuit correctly. There is nothing wrong here.

A Grid Fault

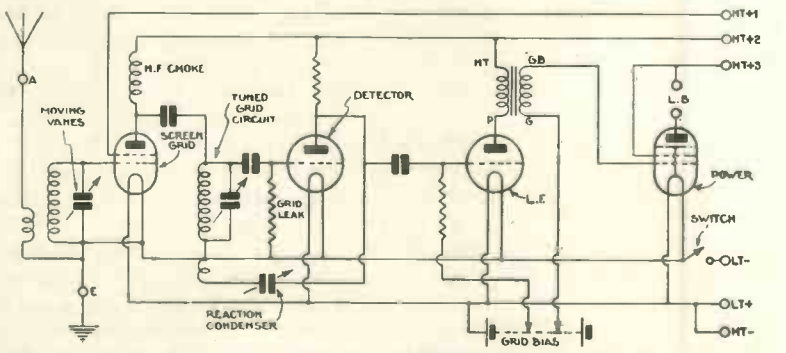
The grid condenser is right, but the grid leak is wrong. It goes between the grid and negative low tension. Connected this way results will be obtained, I know, but all the same the connection is wrong. The grid leak should normally be joined between the grid and *positive* low tension.

For the finest results the leak may be taken to a point between positive and negative low tension, but this is seldom necessary.

To connect the grid leak between the grid and positive low tension is right. This allows grid current to flow and grid current is essential for detection when this type is used.

In the anode circuit of this detector is a resistance coupling and reaction. There are one or two things wrong here. In the first place both sides of the reaction condenser are "alive," that is, have a high-frequency potential to earth. You may get bad hand effects or not, depending upon the size of the condenser and the reaction coil.

It is definitely better to place the reaction condenser between the coil



This is the circuit diagram of a simple set as a beginner might draw it. There are a few faults which will not prevent results from being obtained, but which, if removed, would result in better reception

and negative low tension. The moving vanes of the condenser are then earthed and trouble is avoided.

The next point is that the high-frequency currents which appear in the anode circuit of the detector have not a convenient path to the filament, except that via the reaction circuit.

This is not good enough. I always connect a fixed condenser between the anode and the filament, sometimes a .0001 microfarad and sometimes one as large as .0005. It depends upon the valve and circuit.

This condenser helps to improve the detector and also tends to stabilise the set. It passes most of the high-frequency currents to the filament, instead of allowing them to stray through to the low-frequency amplifier to cause squeals and howls.

If the condenser is *too* big, the higher notes may be weakened and reaction effects be reduced, necessitating a larger reaction coil.

Circuit Instability

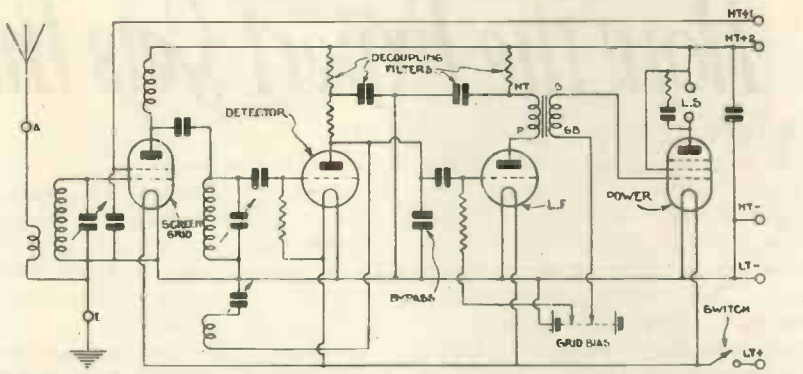
There is yet another thing wrong with the anode circuit. You might not notice anything seriously the matter with a good battery. But with an average battery or an old one the chances are that the quality would be poor and there might be signs of motor-boating or instability.

This is because the anode circuit is not decoupled. The anode resistance goes from the anode to the high tension. It is better practice, in fact it is pretty well essential, to connect a filter or decoupling unit between the high tension and the anode resistance. This is shown in the *correct* diagram, and consists of a resistance of about 10,000 ohms and a condenser of 1 microfarad.

Cheap Decoupling

The decoupling circuit costs two or three shillings, but actually may be said to save money in the long run, as high-tension batteries will certainly not have to be thrown away so soon when a decoupling circuit is fitted.

The grid leak of the resistance-condenser coupling goes between the grid of the low-frequency amplifying valve and the grid-bias battery. There is nothing actually wrong here, but if the valve had to be biassed negative 3 volts, then the bottom of the grid leak would have to be taken to 4½ volts, because the grid battery is joined to positive low tension.



Here is the expert's own circuit diagram. The faults shown in the circuit on the preceding page have been removed, the modifications being carried out as described in this article by W. James

Once again the set would work, but if you failed to notice the mistake the valve would have too little bias. The result would be, first, that the anode current would be excessive (leading to waste), and, secondly, there might be overloading troubles. You would naturally bias the valve according to the makers' instructions. If they said negative 3 volts you would fit the wander plug in negative three.

But the bias would, in fact, be 3 less the voltage of the accumulator, that is, 1-volt bias for a 2-volt cell. It is easy enough to correct this mistake; join positive grid battery to negative low tension.

In the anode circuit of this low-frequency amplifying valve is a transformer; its secondary is shown connected the opposite way to the markings of the terminals. The result might be quality not quite up to standard, and the amplification might be down a little.

This is not a serious mistake; in fact, I often try a set with the connection first one way and then the other.

There is usually no need to fit a filter to this circuit, but in " posh " sets you will often find a filter connected between the transformer and the high tension.

The last valve is a pentode. We have the loud-speaker connected directly in its anode circuit which is satisfactory enough when the loud-speaker has its own transformer, and they usually have.

But there is no protective filter, which, by the way, also works as a rule as a high-note filter as well. This filter is usually designed to weaken the higher notes in order that a proper balance of output may be obtained.

So far as weakening the high notes is concerned, this may well be accomplished in an earlier stage, but there may be times when excessive voltages would be built up in the output circuit and across the valve if no filter were fitted. It is, therefore, customary to fit a filter consisting of a resistance of about 15,000 ohms and a condenser of about .01 microfarad across the loud-speaker.

There are one or two more strange things in this circuit. Thus H.T. negative is shown connected to L.T. positive; it should be joined to L.T. negative. The filament switch is in the negative side of low tension. Put it in the positive side; then it will break the circuit properly.

High-tension Condenser

Also, connect a condenser across the high-tension battery. A 2-microfarad condenser might be joined between H.T.+3 and negative, but a larger condenser would be better. In most amateur sets a condenser of about 2 microfarads is used, but I would prefer an electrolytic condenser, having negligible leakage and a capacity of, say, 25 microfarads.

This helps especially when the battery is getting old and has a high resistance.

There are numerous other points of interest in a set, and only the simplest have been mentioned because they are the most likely ones that a beginner is apt to overlook. Extra care is necessary in mains sets when a metal covered baseboard is used or a metal panel. One fault may well spoil the results, and half a dozen wrong connections may do no more than lower the efficiency of a set by a small amount.

By the "W.M." Set Selection Bureau

WE TEST BEFORE YOU BUY

RADIO AT RESTING TIME
This fair listener enjoys an evening programme on one of the new H.M.V. Super-het Portable Grand receivers which incorporate many of the fine features of the well-known H.M.V. ninety-five guinea radiogram

HERE we are nearly at Christmas again, and once more the hordes of set buyers are invading their dealers in search of suitable sets for their own use, or to give as presents to their friends. The fine booklet, which we are presenting free this month, will no doubt enable a large number of readers to make their choice.

However, the time is ripe for us to remind you of our free advice service. If you are in doubt about the suitability of such and such a set for your locality, whether it will get all the foreign stations you particularly want to hear, or if you cannot find the set with a certain cabinet design to match your home decoration scheme, you should certainly consult the Set Selection Bureau.

We have tested most of the season's outstanding sets and we are, therefore, in a position to advise you first hand on the capabilities of modern sets, whether it is a simple battery-operated two-valver or an expensive multi-valve super-het radiogram with a price running into three figures.

The five questions set out in the panel on this page can be answered without any technical knowledge on the part of the inquirer. Any other questions that you may like to ask should follow the five set questions.

There is no charge of any kind, only a stamped addressed envelope, which must be enclosed with your inquiry.

Tell your friends about this "Wireless Magazine" service; it is unique and free.

A number of recent letters to this Bureau have stressed the importance of using a set with a self-contained aerial. This year there is a shortage of sets with built-in aerials.

We believe that a large number of these people who ask for self-contained aerials in sets are under a misapprehension regarding the capabilities of the modern set. They believe that the only alternative to a built-in aerial is either an elaborate indoor aerial or an efficient outdoor type.

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."

Modern sets do not want a big aerial. The average four- or more valve super-hets will give a thoroughly good performance on a short piece of wire about 10 or 15 ft. long. The picture-rail round the room is the ideal place for this wire.

Surprisingly good results can be obtained from the most popular of this year's sets, the four-valve table super-het, on the small indoor wire of the type just mentioned. At night-time we have found that all the worth-while Continental stations can be logged at full loud-speaker strength on the indoor wire. During daylight, however, the number of foreigners logged is not so great as with an outdoor wire.

Of course, if you live up in the wilds of Skye or the desolate valleys of Wales, you will find the outdoor aerial of great advantage and, in fact, almost a necessity.

The old rule about an efficient earth still holds good. Although many sets will work nearly as well without an earth, it is always an advantage to have a good one. Half the trouble of bad mains hum is *caused* through an inefficient earth.

Just as we are going to press comes news of a super-het portable, an entirely new model released by the Gramophone Co., Ltd. This new set, the H.M.V. Super-het A.V.C. Portable Grand, is a de-luxe battery set with many fine features, such as automatic volume control, moving-coil loud-speaker, push-pull output, illuminated scale and many others of those things that go towards making a first-rate job.

The set is housed in a very attractive walnut cabinet, a very modern design, with recesses in the sides which make it easy to carry from room to room.

An up-to-date circuit arrangement of six valves in super-het sequence is used with a Westector for second detector. Price fifteen guineas.

Telsen 464 A.C. Receiver

BRIEF SPECIFICATION

MAKERS: Telsen Electric Co., Ltd.

MODEL: 464.

PRICE: £9 9s.

VALVE COMBINATION: Screen-grid high-frequency amplifier (Mullard SP4), detector (Osram Catkin MH4), pentode (Mazda AC/Pen), and valve rectifier (Micromesh R2).

POWER SUPPLY: A.C. mains, 200-250 volts.

TYPE: A neat table A.C. three-valver with self-contained moving-coil reproducer. Needs only aerial and earth to complete installation.

REMARKS: Wonderful value for money. A simple three-valver that, if correctly tuned, is very selective. Quality good.

THERE must be dozens of people who really cannot afford an expensive all-mains receiver and feel that those A.C. sets in the cheaper price category do not give a first-rate performance. We specially draw the attention of these listeners to this new Telsen three-valve all-mains set.

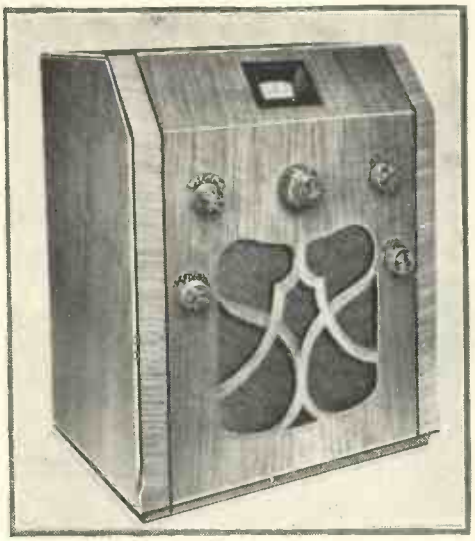
It is really very cheap and, in spite of its low cost, the performance is particularly good. Both sensitivity and selectivity are above the average for a set of its type and quality must be heard to be believed.

To the casual observer this set with its five knobs on the front may appear a difficult set to operate. You can see how they are arranged from the photograph. All the knobs, with the exception of the main tuner with its superimposed trimmer on the centre, have a small ivorine disc above on which is engraved the purpose of the knob.

The reason for the many knobs is that Telsen have not used any combination controls; one knob on this set does one thing only. On the left is the aerial-input control above the tone control, and on the right is the reaction above the wave-change switch. The set is switched on and off by a small toggle switch on the back of the set chassis; the switch can be seen in the back-view photograph.

This 464 is a little larger than average midget set. The cabinet, finished in a quiet shade of walnut, is only 11½ in. wide, 14¼ in. high, and 8¼ in. deep: so small that it will stand almost anywhere in the house without looking out of place.

That little cabinet is full up with works; there is no waste room. The set is arranged on a two-tier metal chassis with the mains transformer, ganged condenser and coils with the four valves in line on the top tier with several small parts underneath. All the smoothing gear, a large low-frequency choke and electrolytic condensers, is arranged round the loud-speaker on the bottom tier.



"It is really very cheap and, in spite of its low cost, the performance is particularly good."

A feature of the construction is that all the parts that may need replacement in time to come are very accessible. Even the fixed resistances, eight of them, are neatly mounted on a bakelite strip along the bottom.

There are no frills in the circuit: it is quite straightforward. There are only two tuned circuits, a loosely coupled aerial coil with a selectivity adjustment, and tuned transformer coupling between the high-frequency amplifier and the detector. Quite an assortment of valves are used. A Mullard high-frequency pentode is used in the high-frequency stage, an Osram metal valve for the detector, which is transformer-coupled to the output pentode, a Mazda, by the parallel-feed system.

So much for technicalities. We tried the set on our standard outdoor aerial in South London, and the results were especially good. We found London Regional very easily, and then took stock of the behaviour of the controls. All of them worked smoothly and were definite in their action.

Quality is bound up entirely with the setting of the tone-control knob. The makers merit congratulation on this device, which is *not* a top-note cutter. With the tone control we found that either the top or bottom notes could be accentuated. The tonal flexibility together with the fine power of 2.5 watts from the output pentode gave quality that would be a triumph for a set costing double the price.

"That little cabinet is full up with works: there is no waste room. The set is arranged on a two-tier metal chassis. . . ."

Selectivity was very satisfactory providing the set was handled correctly.

During the course of an hour handling of the dials we heard over twenty stations that provided good entertainment from the medium waves and about six or seven from the long. Luxembourg on the long waves fairly " shook " the test room.

Daylight results were good, too. Seven or eight foreigners were logged without any trouble: Brussels No. 1, Kootwijk, Langenberg, Hilversum and Luxembourg were the best of the bunch. That is good value for money surely!

Murphy B5 Battery Super-het

IT is with real delight that we report favourably on this Murphy battery-operated super-het. Here our friend Mr. Murphy has combined the excellent selectivity of the super-het with the good volume and quality obtainable from class B to produce a notable battery set, which gives results comparable with many present-day all-mains supers.

We will not bother you with hard technical facts about the B5. Briefly, the circuit consists of five valves in super-het sequence, with one stage of intermediate-frequency amplification. A notable point is the use of a pentode as combined oscillator and first detector.

This is one of the few of this year's sets having a rosewood-finished cabinet inlaid with walnut. All you want to know about the set's appearance can be seen from the photograph. We think it is one of the nicest-looking battery sets that has taken its stand on our test bench. The neat loud-speaker fret is backed with silvery-blue silk.

Now about the four control knobs; all of unconventional shape, coloured black. The knack of handling these controls is soon grasped. In the centre the top knob operates the tuning scale; illuminated when the set is switched on and calibrated in wavelengths only.

Below the tuning knob is the tone control, the function of which we will say more about later. The control on the extreme left is the volume control and on the right the combination on-off and wavechange switch. This works in an anti-clockwise direction, the first turn switching the set for medium-wave work, then a further turn for the long waves.

"Briefly, the circuit consists of five valves in super-het sequence with one stage of intermediate-frequency amplification." A pentode is used as a combined oscillator and first detector

"Mr. Murphy has combined the excellent selectivity of the super-het with the good volume and quality obtainable from class-B to produce a notable battery set"

All these controls worked particularly smooth and decisively during our tests. These tests started with a run round the medium waveband; a 35-ft. outdoor wire was used. The B5 behaved like a good super-het should behave. There was no difficulty in getting stations or in separating them.

Wavelength calibrations were particularly accurate. London National, London Regional, and North Regional all came in dead on their wavelength calibrations. Selectivity was good. On the medium band Toulouse and Leipzig were clear—a good test nowadays. Sensitivity needs no remarks except to mention that our log for the evening totalled some fifty odd stations on the medium band.

We were more than pleased with the B5's long-wave performance. Daventry and Radio Paris were two fine signals, but both spoilt reception of Berlin, sandwiched between them. Good use of the tone control enabled us to reduce the interference to negligible limits. We easily separated Kalundborg and Luxembourg at the bottom of this band— a notable selectivity feat.

Now about that tone control. It has two distinct advantages in this set. One is that it enables the user to choose his own tone. He has the choice of the popular mellow tone or a well-balanced tone with plenty of top, which we are inclined to favour.

Secondly, the control is a distinct advantage in clearing interference on a station caused by the station on the next wavelength channel. Often a signal wanders out of its channel and, by cutting top notes slightly, the interference, though not often cured, is suppressed to almost nothing.

The quality of this set is well worth the addition of a pick-up. An external volume control is, however, necessary. A plug and jack is fitted on the back for this purpose.

A glance inside the set showed the sturdiness of the construction. The batteries, a high-tension combined with grid bias, and an accumulator, fit on a small shelf behind the permanent-magnet moving-coil loud-speaker. The set chassis, a well-engineered job, is at the bottom.

There are plugs on the back of the set chassis for connecting both the internal and an exterior loud-speaker. The internal reproducer can be cut out when using an exterior type or used in parallel with it.

We measured the anode current and found that it varied between 7½ milliamperes quiescent to about 15 milliamperes on loud passages. The average is about 10 milliamperes, which is very economical.

BRIEF SPECIFICATION

MAKERS: Murphy Radio, Ltd.

MODEL: B5.

TYPE: Five-valve battery super-het with class-B output, in rosewood finished table cabinet.

PRICE: £14 10s.

VALVE COMBINATION: Combined oscillator-detector (Cossor 220PT), intermediate-frequency amplifier (Mullard PM12M), second detector (Mazda HL2), driver valve (Mazda L2) and class-B output (Mazda PD220).

REMARKS: A sensitive battery super-het giving good quality from all home and worth-while foreigners. Appearance attractive.

Ferranti Parva Super-het

"The cabinet, really quite small, has attractive and neat lines."

". . . this Lancastria Parva is one of the good things of present-day radio. It is cheap and attractive . . . ."

JUST reduced from fifteen guineas, this Lancastria Parva is one of the good things of present-day radio. It is cheap, attractive, and, though one of the many four-valve A.C. super-hets available this year, it is one of the best.

The four valves are arranged in standard super-het sequence consisting of a combined oscillator and first detector, one stage of intermediate-frequency amplification, second detector and a triode output. An interesting point is that a Ferranti heptode is used as detector-oscillator.

The cabinet, really quite small, has attractive and neat lines. Although it does not come under a midget classification, its size, 10½ in. wide, 8¼ in. deep, by 15½ in. high, makes it suitable for fitting in almost anywhere in the home.

Cabinet lines you can see from the photograph; it is finished in walnut with an attractively inlaid front.

We tried the set under our standard conditions in South London and were immensely pleased with its performance. Directly we handled the controls and turned the tuning knob we knew instinctively that we had got hold of a really good outfit. We started off at the bottom of the medium waveband and worked upwards.

You know that it is usually more difficult to log entertaining signals below 300 metres. We will mention just one notable feat of the Parva in this region. This was the logging of Bari, Rennes and Turin. It is not many sets that will enable the listener to get Rennes clear of Italian interference. It was easy on this set and the strength was good.

The reception of Vienna at the top of the medium band and Trieste, at the bottom, at almost the same strength without any adjustment of the manual volume control showed the constant sensitivity and the fine action of the automatic volume control.

Altogether our log for the medium band totalled some fifty signals. Very good! We were particularly pleased with the fine action of the automatic volume control. Many of the foreigners came in at the same strength and there was little noticeable fading.

Long-wave performance pleased us, too. Berlin was clear and the overall sensitivity enabled us easily to log the dozen best signals of this band. Quality was that happy medium between excessive and not quite enough top. The tone is round, well balanced and should please the most critical ear. We noticed a little box resonance—nothing to worry—but it must be expected with such a small cabinet.

Like all good modern sets this Lancastria Parva is very simple to handle. There are three controls on the front. The centre knob, for tuning, operates a neat scale calibrated in wavelengths. This is illuminated when the set is working.

The left-hand control is a combined on-off and wavechange switch. The first quarter turn switches the set on for medium-wave reception; a further twist adjusts the set for long waves. The other control on the right is the manual volume control. Ferranti's give some useful hints on the correct adjustment of this control in their instruction leaflet.

You can get some idea of the soundly engineered construction from the interior-view photograph. It is so well built that the set will work equally well upside down; the makers do not advise this course. All coils, valves and mains transformer, with the exception of the triode and the valve rectifier are totally screened. To get at one of the screened valves, the metal plate across the top is lifted off and then the metal can easily slides off.

The mains transformer adjustment is in the centre just underneath the energised moving-coil loud-speaker.

On the back of the chassis are terminals for aerial, earth and pick-up—not sockets and plugs. An external loud-speaker can be used; two terminals for this purpose are fitted on the matching transformer on the loud-speaker. Altogether a well-designed little job.

BRIEF SPECIFICATION

MAKERS: Ferranti, Ltd.

MODEL: Lancastria Parva.

TYPE: Four-valve A.C. super-het in table cabinet.

PRICE: £14 3s. 6d.

VALVE COMBINATION: Fou valves in super-het sequence. Combined oscillator and first detector (Ferranti VHT4), intermediate-frequency amplifier (Ferranl VPT4), second detector (Ferranti H4D), triode output (Ferranti LP4), and valve rectifier (Ferranti R4).

POWER SUPPLY: 200-250 volts A.C. mains.

REMARKS: A super-het of attractive appearance that gives equally attractive results. Cabinet is small and neat.

Marconiphone Super-het Radiogram

HERE is one of this season's finest super-het radio gramophones. Perhaps rather on the expensive side, but it is well worth every penny of its price. The nucleus of the instrument is a well-designed super-het circuit employing six valves, two Westectors, and a valve rectifier. One of the Westectors is used for providing automatic volume control, and the other acts as second detector.

The output valve is a PX4, a large triode well known for its good quality and large power output: just over 2 watts. This valve drives a large moving-coil loud-speaker of Marconiphone design.

The handsome external appearance of the model 290 calls for little comment. It is one of the nicest-looking radiograms that we have had the pleasure of testing. Finished in the conventional Marconiphone dark walnut, the big cabinet is inlaid with contrasted walnut and ebony. The attractive, yet very plain loud-speaker fret is tastefully backed with old-gold silk.

"Here is one of the season's finest super-het radio-gramophones . . . . It is one of the nicest looking radiograms that we have had the pleasure of testing."

BRIEF SPECIFICATION

MAKERS: Marconiphone Co., Ltd.

MODEL: 290.

TYPE: Seven-valve super-het radiogram in handsome walnut cabinet.

PRICE: £44 2s.; Model 291 with record changer, £52 10s.

VALVE COMBINATION: Six valves in super-het sequence, with Westector as second detector and another for providing automatic volume control. PX4 output triode and valve rectifier (Marconi U12).

POWER SUPPLY: A.C. mains, 200-250 volts.

REMARKS: A mains radiogram for the connoisseur. Gives fine quality from dozens of stations. A handsome cabinet.

Like all the big radiograms turned out by this firm, all the controls, with the exception of the volume control, are mounted on the motor-board to the right of the gramophone turntable,

Tuning is the essence of simplicity: there are only three tuning controls on the motor-board. On the side of the moulded escutcheon in the centre is the tuning control, which works two separate tuning scales both calibrated in wavelengths and marked with the names of the best European and home stations. We found these markings dead accurate during our tests.

The knob to the front of the tuner is the tone control, and the other control at the back is the combination switch. This operates the wave-changing, switches the set on and off, and acts as the gramo-radio switch. This may seem rather complicated, but thanks to the brilliant method of scale illumination there is no possibility of confusion.

". . . all the controls, with the exception of the volume control, are mounted on the motor-board to the right of the gramophone turntable."

When the set is tuned to the long waves, only the long-wave scale is illuminated. It is the same for the medium waves, and when the set is being used for record reproduction the word " Gramophone " shows through the aperture in the centre of the escutcheon. All is dark, of course, when the set is switched off.

On the other end of the motor-board, the gramophone accessories are neatly grouped round the turntable. There is an auto-brake which switches off the motor after a record has finished playing, needle-cups and even a small rack for special packet needles.

On the mains voltage adjustment panel, which is right inside the set, are the usual fuses and a hum adjuster. Not that you will need this adjuster: we found the set almost hum free. At the back of the set chassis, in a very convenient place, is the plug and socket panel with two other knobs. One is a static suppressor for use if the user is troubled with electrical interference—a kindly thought on the makers' part—and the other a switch for use with external loud-speakers.

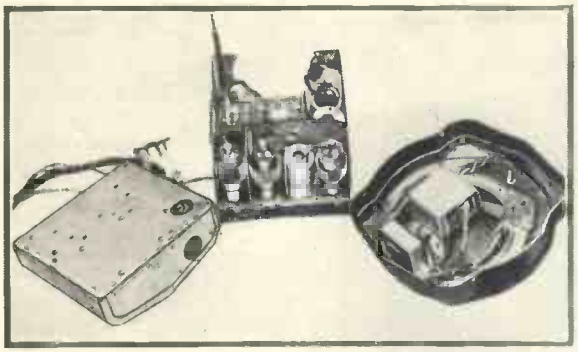
During our tests in South London on a normal outdoor wire 35 ft. long, we logged well over seventy stations during the course of the evening. That shows what a good station-getter this set is. Selectivity was well up to super-het standard; both Mühlacker and Graz were easily received clear of London Regional.

It was here that we noted the excellent action of the automatic volume control. Graz and Mühlacker were heard at about the same strength, and there was no " blasting " as we tuned through London Regional.

Long-wave results were equally impressive. We found no difficulty in separating the worth-while stations; Berlin was quite clear of its neighbours. Our total log for the whole evening totalled some eighty-five stations. On a 7-ft. piece of flex curled up under the set we easily brought in most of Europe's worth-while stations. That is good proof of the sensitivity.

Quality was well up to Marconiphone standard; there is no need to say more. Tone you can adjust to suit your own whims and fancies.

Arvin No. 20-B Car Radio



"The set is interesting as a fine example of an American-built six-valve super-heterodyne with gang control . . . the set chassis, vibrator and loud-speaker removed from the cabinet"

THERE is an increasing market for car wireless receivers and one of the latest to be introduced to this country is the Arvin.

In many respects this is an unusual receiver as the super-heterodyne chassis vibrator converter power unit and loud-speaker are contained in one pressed-steel case, which is fitted inside the car and which, having a fancy fret front, need not be hidden behind the facia board.

There is a remote-control tuning unit carrying an illuminated dial, on-off switch and volume control, in addition to a very practical tuning control. The connection between the tuning unit and the set is by means of a Bowden-type control and a cable.

The photograph above shows the set chassis, vibrator and loud-speaker removed from the cabinet, while the right-hand photograph shows the neat job of the complete set, together with the extension control.

From a technical point of view the set is interesting as a fine example of an American-built six-valve super-heterodyne with gang control. All the valves are shielded and there is an effective automatic volume control arrangement.

Indirectly-heated valves are used, of course, including a double-diode pentode. The output circuit is arranged on class-A lines and gives 4 watts output to a 6-in.-diameter energised loud-speaker.

High tension is obtained by the very ingenious means of transforming the car starter battery 6- or 12-volt direct-current supply to low-voltage A.C. by means of a buzzer vibrator. This A.C. is then stepped up with a transformer and rectified by a type 84 full-wave rectifier. Ample high tension is obtained in this way and there is a virtually silent background even when no stations are being received. When a station is received at normal strength and the automatic volume control comes into action there is no background noise at all.

Current is taken from the car battery for heating the valves, feeding the high-tension vibrator and energising the loud-speaker. The current consumption is approximately 4.6 amperes, which is very reasonable.

BRIEF SPECIFICATION

MARKETED by The Arvin Electric Co.

PRICE : £16 16s.

VALVE COMBINATION : Six-valve super-heterodyne circuit with double-diode pentode, automatic volume control and class-A output.

POWER SUPPLY : All current taken from the car starter battery for valve heating, high tension and loud-speaker energising. Current consumption, 4.6 amperes.

On test this car radio installation gave evidence of careful super-heterodyne design. The ganging is good over the whole medium-wave tuning scale, and although the set does not cover the long waves, the medium-wave scale is nevertheless broad. The tuning scale is calibrated from 0 to 100 and as an indication of the way in which stations come in it may be cited that London Regional is received at 60 on the dial and London National at 40. The 500-metre stations are received at 85-90. Selectivity is very satisfactory and is of actually a higher order than is needed in the average car, but of course this is a good feature.

Tone control is provided by means of a switch on the front of the set which cuts a condenser filter circuit in or out of the loud-speaker wiring.

". . . the neat job of the complete set together with the extension control. . . . Altogether in general handling and performance this is a convincing car radio installation"

This is a valuable feature, for the exact tone level required in a car radio installation depends on the acoustic properties of the car body in which the receiver is worked. These may vary according to the number of passengers in the car (which alters the amount of sound damping) and the engine noise level. It is therefore very convenient to be able to remove some of the top frequencies at will by means of the switch. Reproduction is very brilliant with the condenser arrangement out of circuit, but there is ample bass, and the tone is good.

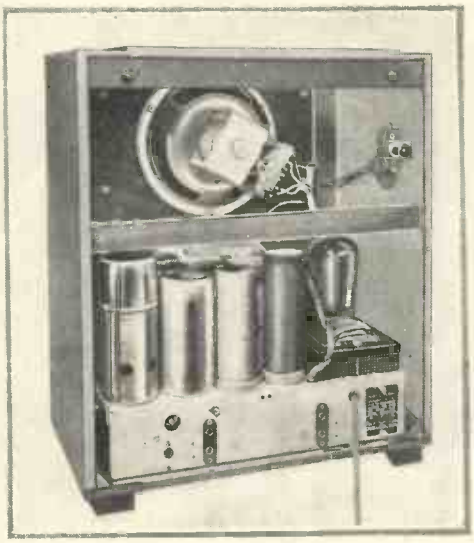
A very efficient kit of suppressors is supplied with the Arvin receiver. There are resistances for six sparking plugs, the distributor, and a shunt condenser for the dynamo wiring. The car in which this receiver was tested had been equipped with these suppressors, and a very quiet background was obtained in spite of the great sensitivity of the set's circuit. In running there is no noticeable noise from the engine's electrical equipment, and only slight interference is picked up from passing cars. No very elaborate aerial is needed, and it was found possible to pick up nearly a dozen stations with no aerial connected.

Altogether in general handling and performance this is a convincing car radio installation.

G.E.C. Super-het Five Receiver

THIS new all-mains super-het admirably lives up to the G.E.C. tradition for producing sets with sound technical designs that give splendid results in practice. The Super-het 5 is, without a doubt, a leading set of this year's glut of four-valve supers.

We like the cabinet of this set. It is of quiet design and finished in a handsome walnut veneer. The pride of place on the front is taken up by a large full-vision tuning scale, evenly lit by two bulbs when the set is on. The scale is marked in both stations and wave-lengths; forty of the best-received stations are marked in red and black; red for British and black for Continental stations.



"The makers have followed the conventional idea of a set built up on a metal chassis and fixed at the bottom of the cabinet."

"We like the cabinet of this set. It is of quiet design and finished in a handsome walnut veneer."

Control is particularly simple: any novice could handle the set after a minute or so practice. In the centre below the tuning scale is the main tuning control, which moves a fine pointer across the scale. To the left of this is the combined on-off switch and volume control, and to the right the rotary wave-change switch.

Another commendable feature is the useful tone control which has been fixed in the centre of the loud-speaker fret—a sensible place. With this control the tone can be varied by reducing the upper frequencies to suit individual tastes. Quality is, in fact, one of the strong points about this set. The energised moving-coil loud-speaker fed by a pentode gives a well-balanced tone that should please the most critical listener.

Inside the makers have followed the conventional idea of a set built up on a metal chassis and fixed at the bottom of the cabinet with the moving-coil loud-speaker just above. On the back of the set chassis is the usual aerial and earth, external loud-speaker, and pick-up sockets. A small push-pull switch is fitted at the top of the cabinet so that the internal loud-speaker can be cut out of circuit when an exterior model is used.

The mains adjustment panel is reached by unscrewing two small screws which hold a metal protection cover over the panel. Adjusting the voltage of the set to that of the domestic mains is a simple business: there is only one movable link to be fitted between appropriate screws.

The layout on top of the metal chassis is quite conventional; all parts except the valve rectifier and the output pentode are screened to ensure stability. Quite a straightforward circuit arrangement is used. A screen-grid valve acts as combined detector and oscillator, a variable-mu is used in the intermediate-frequency stage, another screen-grid for the second detector, which is resistance-coupled to the pentode output.

We were very pleased with the performance put up by the set during its tests in South London, about 20 miles from Brookman's Park. We used our own standard outdoor aerial about 35 ft. long, and also the set's own *petite* interior aerial, which consists of a 15-in. length of wire fixed by adhesive tape to the cabinet back.

On our own aerial at night we were able to clear Mühlacker from London Regional and Frankfurt from National, so sharp was the tuning. In our run round the dial, which lasted about an hour, we logged all the worth-while stations on the medium band at remarkably good strength. We were pleased to find that background noise had been almost entirely eliminated. Except when listening to such far-away signals as Copenhagen or Algiers, the noise was hardly noticeable.

On the set's own aerial, which the makers suggest is for local station reception, we heard the three or four of Europe's best stations—Leipzig was the best—as well as the two London stations at full loud-speaker strength.

Long-wave sensitivity was good: we logged over a dozen signals in less than an hour. Luxembourg was the best of the foreigners.

BRIEF SPECIFICATION

MAKERS: General Electric Co., Ltd.

MODEL: Super-het 5.

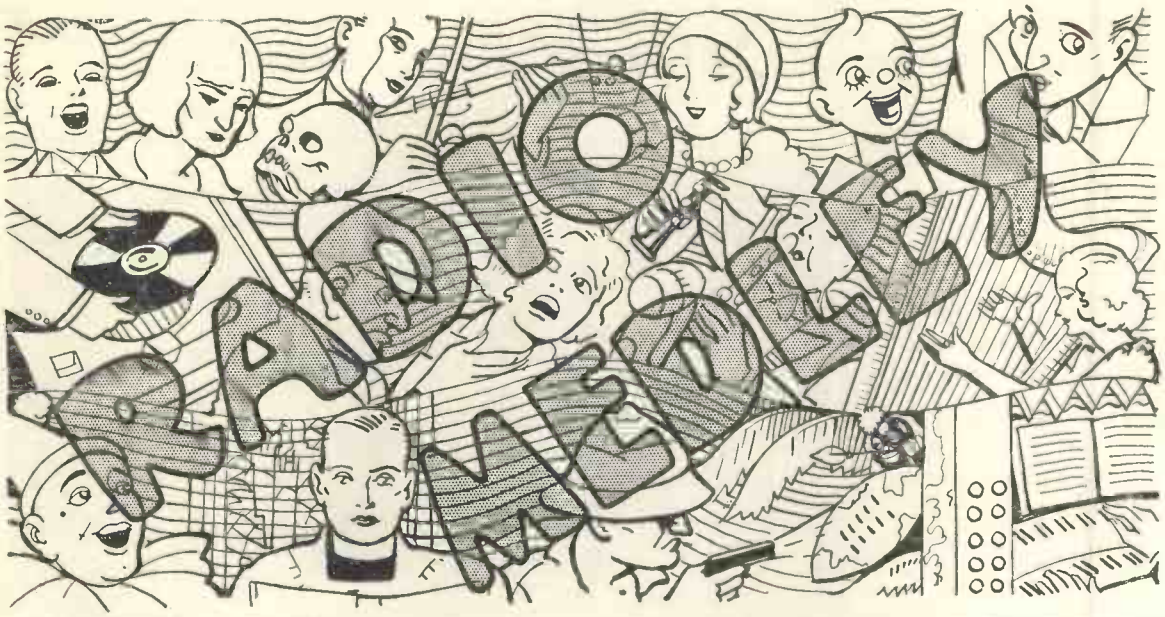
TYPE: Four-valve A.C. super-het receiver in consolette cabinet, with built-in moving-coil loud-speaker.

PRICE: £14 14s.

VALVE COMBINATION: Screen-grid first detector and oscillator (Osram MS4B), intermediate-frequency amplifier (Osram VMS4), second detector (Osram MS4B), pentode output (Osram MPT4), and valve rectifier (Osram U12).

POWER SUPPLY: A.C. mains, 190-250 volts.

REMARKS: An exceptionally sensitive super-het, giving good quality from many stations. Cabinet and full-vision scale particularly attractive.



A Radio Fan's Causerie: Conducted by BM/PRESS

Post Office Activities

THE Post Office has recently been showing renewed activity in radio matters. Not in the way of collecting licence fees from pirates, but in purely technical matters which are likely to help the listener. First of all there was the opening by the Prime Minister of the new research laboratories at Dollis Hill. I have not seen them, but two of my friends have been up there and tell me that it is an amazing place.

Perhaps one of the most interesting places in the building is a padded room for the testing of loud-speakers. Then there is a high-voltage laboratory that must be intriguing to visitors. The last time I was up at Ferranti's I got quite a thrill when a 6-ft. spark was produced!

Tracking Interference

Another Post Office activity that should be noted by all listeners suffering from any kind of external interference is a simplified method of getting aid in tracking it down. I understand that now you can go along to the nearest branch office and ask for an electrical-interference form, which, incidentally, has been much simplified in format.

The completed form, which can be sent post free, is subsequently handed to the sectional engineer of the area in which you live, and as soon as possible a man is sent round to find out all about your trouble. What is more, the service is quite free of charge—unless some apparatus is needed to cut out the interference, when the question of payment has to be settled between the listener who is interfered with and the owner of the interfering apparatus.

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My Earth Plate

I mentioned a little time ago that I was going to scrounge a copper plate from Mr. H. A. Pearson, the printing manager of the Sun Engraving Co., Ltd., who make such a good job of "Wireless Magazine" each month. Well, at last I have got the plate, which measures nearly 4 ft. by 3 ft., and is of substantial thickness, and have taken it to my flat.

You will remember that it was my intention to use this mat under the carpet as a counterpoise capacity. Well, I duly connected it to the set—and got an unpleasant surprise. Instead of the improvement in reception that I had anticipated, I found to my surprise that signals were reduced in volume by an appreciable amount.

A Puzzle

This puzzled me; and in spite of

RADIO IN THE KITCHEN
The housewife who does her own cooking will find radio a boon. The set seen here is the new H.M.V. Super-het A.V.C. Portable Grand

the explanation advanced by friends, I am still puzzled. I am told that the loss in strength must be due to the fact that the set goes into oscillation when the earth plate is connected. That is as it may be, but I do not think it is very convincing. Still, it may be something of the kind, for the power valve, which normally has a distinct blue glow, goes even bluer when I do connect this earth!

For the time being, therefore, I am getting the efficient reception I have been enjoying for some months *without* any kind of earth. As soon as I am able to, I shall change my set and try something different. Perhaps I shall hit on something which will enable me to use this large sheet of copper to advantage! Otherwise what a waste of good scrounging!

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Radio Ghosts!

After Mars, ghosts! You will find in this issue an intriguing article by Derek England on radio ghosts; I happened to see a proof of it when I was in the "W.M." offices one afternoon recently. You will be able to read it for yourself and draw your own conclusions.

What interested me just as much was a letter I saw from Mr. Harry Price, honorary director of the well-known National Laboratory of Psychical Research. Mr. Price is interested in all kinds of strange phenomena and has spent a great deal of time and energy in investigating them. In the course of his letter he said:

"I am not aware that high-frequency currents and electro-magnetic waves have anything to do with psychic phenomena. Of course, if they are psychic, they can have nothing to do with electricity.

"I think that electrical or magnetic waves of some sort may be responsible for the phenomena exhibited by the dowsers or water-diviners. These manifestations are sometimes called psychic, but there is no scientific evidence that such is the case. They are much more likely to be of a psychical nature.

"Of course, we *use* electricity very much in our work here, including infra-red and ultra-violet rays. Also, we have one medium, Miss Stella C. (about whom I have written in my *Leaves from a Psychist's Case-book*, recently published) whose phenomena—which included percussive lights of an electric nature—were thought to be of electrical origin."

In view of this month's article and the recent one which dealt with the effects of earth rays in Germany, Mr. Price's comments are interesting.

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Battery Popularity

It seems incredible in these days of electricity and the use of mains power for many more domestic purposes that the demand for batteries should increase. But that is undoubtedly the case; and it is proved in a very striking manner by the fact that the Ever Ready people have just had to open their eighth London factory to meet the increase in demand.

This makes their twenty-eighth works in all; altogether they occupy one and one-third million square feet of floor space and employ over 12,000 people.

The latest addition to the Ever Ready group of factories was opened at Forest Row, Walthamstow, recently, and I spent an enjoyable couple of hours touring the building. Some idea of the modern fittings can be obtained from the photographs on the next page. Hundreds of girls are employed in the production of batteries of all types.

An interesting point, by the way, is that Ever Ready claim this to be the only factory in England in which production is carried through from raw material to a finished battery.

INTRICATE VALVE MANUFACTURE

Delicate handling is needed in valve manufacture. This young lady in the Cossor works is spot-welding one of the new DD/Pen's

NO WONDER SHE'S SMILING!

A fine collection of unbreakable Catkin valves. And it won't matter if she does drop one or two!

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Crystal Reception

Why is crystal reception so badly neglected nowadays? I know that headphones went out of favour because of people's objection to being tied to their radio sets like a dog to a kennel, but it is strange that the whole subject has been dropped as it has.

One friend of mine who lives about fourteen miles from Brookman's Park has a set with a tuning coil and a Westector which he uses for headphone listening whilst in bed.

Another friend told me the other evening that he would welcome a good pair of headphones for listening to radio plays. His family are not very interested in this form of drama and he has great difficulty in getting them to sit quietly for an hour when he does want to listen to some particular broadcast.

BATTERIES FOR HIGH TENSION

At work in the new Ever Ready factory recently opened at Walthamstow. These girls are soldering batteries before the final assembly

"With a good pair of headphones," he explained to me, "I could shut my eyes and so far detach myself from the family atmosphere as to be able to enjoy radio plays properly."

What is needed is a very much better type of headphone than has been available in the past. I understand that a certain German firm does make a pair of phones with a moving-coil drive. If any reader has had experience of them I should be interested to hear details.

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Electrical Music

From time to time in "Wireless Magazine" you have read articles on music produced from electrical instruments. Recent articles have dealt with the Neo Bechstein and Electronde instruments in particular.

It is interesting to note, therefore, that H.M.V. have just issued discs of the music produced by these two unusual instruments. The Neo Bechstein records were issued a few weeks ago and now Martin Taubmann plays *Le Cygne* and Schubert's *Serenade* on H.M.V. B8020.

I am certain that there is a very great future for such electrical instruments and there must be a lot of money to be made from their development.

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Home Talkies

There is considerable interest in certain quarters over the possibilities of home talkies, a development that is closely allied with radio technique as far as the sound reproduction is concerned. It is therefore interesting to note that a special exhibition of all kinds of film apparatus will be open at Dorland Hall (a few yards from Piccadilly Circus) from November 27 to December 9.

I understand that there will be all sorts of interesting novelties on view, including sound-recording and re-recording systems, film developing, etc., and demonstrations of special films.

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Radio Societies

It is sometimes said that radio societies have had their day. That is true in the main, but there are some very enthusiastic organisations still left. That is proved by the programme of the Radio Section of the New Eltham Ratepayers' Association, which has just come into my hands quite accidentally.

There is a two-hour meeting almost every fortnight from October 5 to April 5. Each session is divided into two parts, the first hour being devoted to an elementary lecture and the second hour to something more advanced.

In case any of my readers live in the neighbourhood and would like to learn more about this enterprising organisation (which is open to people residing outside New Eltham), I may mention that the honorary secretary is Mr. A. E. Gillborn, of 87 Montbelle Road, New Eltham, London, S.E.9.

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New Year Changes

Everybody is wondering what will happen about the Lucerne Plan on January 15. As you know, nearly all the European broadcasting authorities have agreed on certain wavelength changes, but several countries refuse to join in the scheme. There are many arguments as to whether these non-adherents to the plan will upset the whole apple-cart.

One of the big noises at the B.B.C. —none other than Vice-Admiral Sir Charles Carpendale, in fact—has just made a statement to the effect that the plan will come into operation on the appointed date, and that it will be found to work reasonably well in spite of the fact that a number of stations will not, presumably, be working on their wave-lengths.

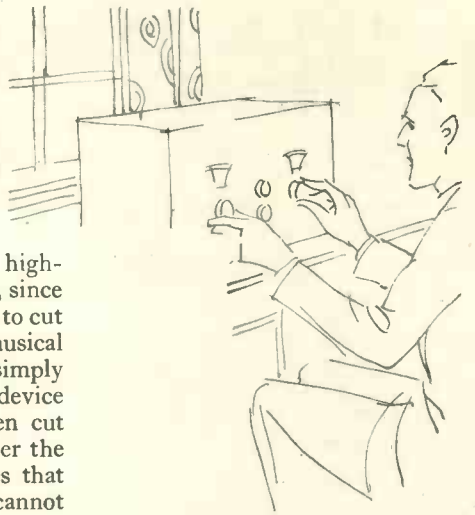
What worries me is the mess people with station-calibrated dials will find themselves in!

London, W.C.1. BM/PRESS

MODERN FACTORIES ARE FINE PLACES TO WORK IN

This photograph of a washing place will be a revelation to many readers who do not come in contact with factory life. Another scene at the new Ever Ready works at Walthamstow

MORE ABOUT Real Quality



By NOEL BONAVIA-HUNT, M.A.

JUDGING from the large number of inquiries received from readers of this magazine, it is very evident that the craving for high quality is insatiable! The general attitude may be summed up in the statement, "We want to make our sets better and still better." And this is the right spirit, for in the end our friends will get what they want, if they will persevere and follow the lead given them in these columns. As I have yet further hints to give our readers on this most absorbing subject, I trust that a perusal of this article will enable those who are interested in quality reproduction to realise their dreams and thus derive a fresh delight from their sets.

Local-station Results

We will suppose that what is chiefly required is a "local station receiver" capable of reproducing the original performance of speech and music not only realistically but also enchantingly. The reception of distant transmissions will, in this case, be a secondary matter, for it is not possible to design a set capable of "reaching out" and at the same time of reproducing speech and music on the local station with the highest standard of quality. Many people are at the present time wasting their time trying to discover such a set. It might have been possible before the ether became so congested with competing high-power transmitters; but that time has passed. In some districts the interference of powerful foreign stations presents so great a problem that high-quality reception is impossible, since the tuning has to be so sharp as to cut off the upper portion of the musical band of frequencies. There simply does not exist any correcting device that can restore what has been cut out: tone correctors merely alter the relative intensities of the notes that are already received, and cannot create additional notes to order.

It hardly seems necessary to make this statement, but quite a number imagine that a tone corrector is able to supply missing notes, which is asking Dame Nature to achieve the impossible. I am of the opinion that the superheterodyne affords the only solution at present of this interference problem, but while it is possible to get a very fair standard of reproduction, especially if diodes are used for both first and second detectors, providing the kilocycle separation is not too small, I am certain that the acme of quality can only be attained by the use of carefully designed straight high-frequency amplification followed by a perfect detector and a perfect low-frequency amplifier. Now it is far easier to obtain the perfect detector and the perfect low-frequency amplifier than it is to design a perfect high-frequency amplifier.

It is quite safe to say that ninety-nine sets out of a hundred are ruined by the high-frequency stage or stages alone, and that no amount of trouble and care spent on the design of the later stages of the receiver can possibly have the slightest effect on the reproduction. I have heard sets that sounded appallingly bad simply because the musical band of frequencies had not the least chance of being rectified, let alone amplified!

So let us turn our attention straight away to the high-frequency side of the set and see what can be done to obviate as far as possible the disadvantages of high-frequency amplifying valves. I deliberately mention the word "disadvantages" because, if the truth must be known, the best state of affairs is secured if we can dispense with high-frequency amplification altogether and apply our wireless signals direct to the input of the detector!

Hand of Welcome!

But that is not possible in these days, for even if we had an outdoor aerial a hundred feet high we should only be holding out the hand of welcome to all the high-power transmitters that could crowd themselves on to our hospitable grid. Since we prefer to choose our visitors, and in fact have no liking for more than one at a time, we must of necessity narrow our door, which unfortunately means that the welcome visitor passes the threshold in an altered and somewhat emasculated form. However, the mischief having been done by the powers that be in Europe, we as individuals are compelled with the best grace possible to adjust our apparatus to the imperfect conditions

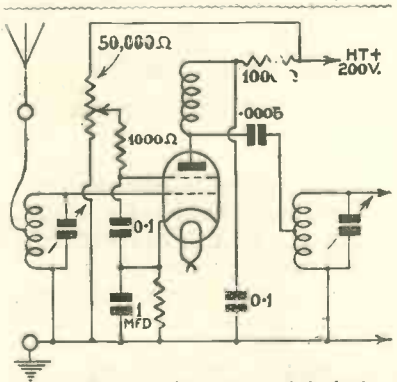


Fig. 1. The complete circuit of the high-frequency amplifier, showing one stage only

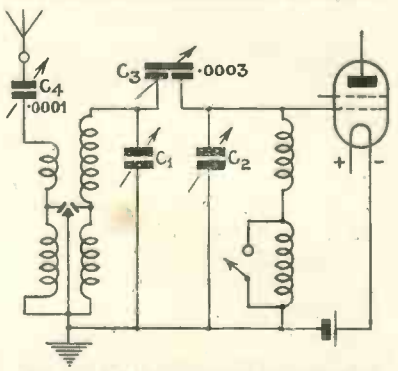


Fig. 2. A band-pass arrangement in which independent control of the condensers is advisable

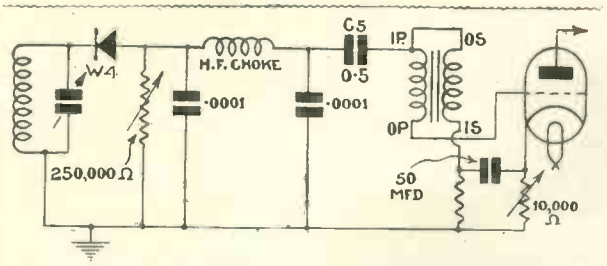


Fig. 3. Details of a detector arrangement in which bias is applied, as described in the accompanying article

forced upon us, and with sufficient skill it is possible to capture our visitor in a fairly recognisable form and to expand that form until he regains his normal size.

Neutralising

The old-fashioned neutralised triode high-frequency amplifier, whatever its faults, did not interfere with the quality of the transmitted signals, providing one was careful to use a small power valve and to neutralise the self-capacity of the valve. The modern screen-grid valve with its high impedance requires a large external impedance in its anode circuit, and can only amplify the complete band of musical frequencies when its associated coupling circuit is most carefully designed. I may say here and now that the most uncompromising part of that circuit is the impedance which is connected between anode and high-tension positive. After long and painstaking experiment I have found that this particular choke winding can only do its real duty when its inductance more or less matches the internal impedance of the valve.

Iron Cores

Supposing the impedance to be 500,000 ohms, the inductance in microhenries of the choke should be as nearly as possible the same. Now even with the introduction of powdered iron cores it is apparently impossible to wind such a choke with a low self-capacity and a reasonably low resistance; nor is it necessary even if it were possible, for all we have to do is to select a valve with an impedance of 250,000 ohms and match it with a choke of 250,000 microhenries both of which are easily obtained. It will then be found that the frequency range of the circuit is extremely large, and not only large but also uniform, which latter condition is most important.

It will be readily understood that a high-frequency transformer will not answer the purpose, since it is not possible to wind a primary coil to the required inductance without upsetting the relationship between this and the tuned secondary. Further, a tuned anode coil coupled through a condenser to a grid leak is even worse, as the amplification of the various frequencies will not be constant throughout the spectrum but will vary with the capacity of the tuning condenser. The choke winding in the anode circuit of the screen-grid valve must be aperiodic and have as high an inductance as possible.

We are told that the variable-mu valve is entirely free from distortion in its handling of signals whether the full amplification available is used or the volume reduced by means of the increased bias. This is not my experience. As the volume is reduced the quality of reproduction suffers very noticeably, as of course it must do; since the uniformity of the complete range of frequencies amplified is no longer preserved. It is safe to say that up to date no really satisfactory volume control has been discovered, and those who assert that the variable-mu valve has solved the problem are either optimists or unable to analyse the conditions under which the valve is operating. If, therefore, a variable-mu screen-grid valve is used for high-frequency amplification it should be treated as an ordinary screen-grid valve with a fixed bias.

There may be plenty of people who on reading this statement will heartily disagree: but it does not prove that their standard of radio reproduction is high. In this article I am taking a very high standard indeed as the criterion by which every circuit arrangement should be judged. Many so-called improvements have been introduced, some good and some bad, and though these novelties serve a useful purpose in keeping up the interest of the public in wireless science, they should be received with caution, for time often reveals defects that the inventor did not foresee at first.

Vari-mu Quality

Another very interesting point about the variable-mu valve is this: if the bias resistance is so adjusted that the impedance of the valve matches the inductance of the external choke winding, the optimum result as regards quality is attained. This phenomenon merely adds a further proof of the correctness of my statement about matching impedance and inductance. It also corroborates the theory that the variable-mu valve should have a fixed bias for the best results.

So much for the anode circuit. This has to be coupled to the grid of the next valve (if two stages of high-frequency are used) or to the detector, as the case may be, in the usual manner, namely through a condenser to a tuned coil. The condenser can be anything from .0005 to .01 microfarad, the value not being critical within these two capacities. The output from the condenser to the tuned coil must be taken either to the top end or the centre tap of the coil: the latter is to be preferred, because we naturally want to make the circuit as selective as possible without upsetting the quality.

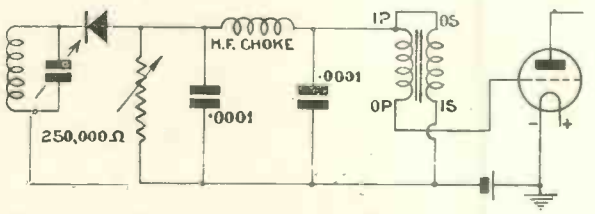


Fig. 4. A similar arrangement to that shown by Fig. 3, in which battery bias is substituted for the biasing resistances

Coil Requirements

The use of a powdered iron core for this particular coil is not recommended, since the higher frequencies are attenuated. In the *aerial* circuit there is not the same objection to the employment of this type of coil: but in the *amplifying* circuits the case is quite different and much mischief can be done by using sharply tuned coils in these stages. The complete circuit of the high-frequency amplifier, showing one stage only, is given in Fig. 1.

I need hardly state that it is essential to take the screen-grid decoupling condenser direct to the *cathode* and not direct to the screening or the earth. This condenser should be placed quite close to the valve-holder. "Valve hiss" is thus minimised if not entirely eliminated. I would also add that the decoupling resistance should not be less than 1,000 ohms, while the capacity of the condenser, which must be of the non-inductive type, may be .1 microfarad.

Circuit Screening

With regard to the screening arrangements, it is the custom nowadays to screen each coil separately and each tuning condenser. Otherwise it is not possible to gang the condensers and obtain one-dial tuning. It must, however, be borne in mind that a certain amount of signal loss is inevitable if this is done, and one stage of high-frequency will probably be inadequate to provide the requisite input volts to a diode detector. When the tuning condenser and its associated coil are placed in a separate screen box much greater efficiency is obtained. But this means two such boxes for a single stage of high-frequency, one for the aerial circuit and one for the high-frequency amplifier: it also means two separate dials. There is no doubt whatever that if the highest standard of quality is to be aimed at, separate tuning controls must be tolerated until some inventor comes forward with a distinctly better system of single-dial control.

Gang Requirements

As a matter of fact, it is easily possible to use a double-ganged condenser to tune the two circuits provided two conditions are observed. The first is the placing of each tuned coil in a reasonably large screen box; and the second is the provision of some arrangement by which each separate condenser can be manipulated independently of the other when desired. The former condition can be fulfilled if the area of the screen is equal to the square of the coil area. Thus, if the latter is eight cubic inches in area, the area of the screen should be not less than sixty-four cubic inches: a box 4 by 4 by 4 in. is thus indicated.

With a single stage of high-frequency amplification it is possible to secure really high-class quality; but if we add a further stage, difficulties at once arise, and our standard of quality is bound to suffer to some extent. My advice to quality seekers is to avoid more than one stage and to use an outdoor aerial. I am aware that there are many folks who are unable to avail themselves of the latter: they live in flats or apartments, and even if an outdoor aerial is possible the external environment is equivalent to a gigantic screen which renders the aerial almost futile. Still, the fact remains that there is nothing like a good outdoor aerial for the quality seeker, and he is fortunate if he is so situated that he can avail himself of this luxury. However, a two-stage high-frequency amplifier is given in Fig. 5 for the benefit of flat-dwellers.

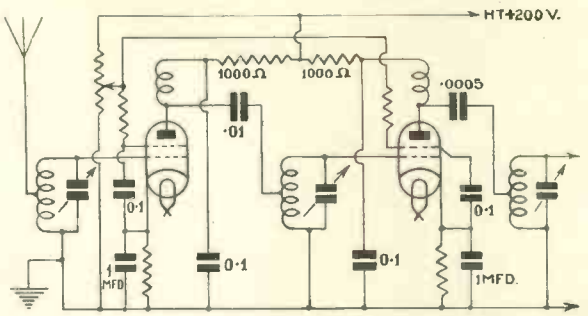


Fig. 5. The theoretical circuit of a two-stage high-frequency amplifier which is of particular interest to flat dwellers where a large aerial is impossible

The next question is that of selectivity. If the aerial coil used in Fig. 1 with its tapped point 15 turns or so from the earth end is not sufficiently selective, there are two alternative methods of increasing the selectivity.

One is the wave-trap, the other is the bandpass filter. The objection to the wave-trap is that it produces a reaction effect on the aerial and causes instability. The objection to the bandpass filter is the extreme difficulty in adjusting the circuits to suit more than one wavelength at a time. The coils have to be most beautifully matched, and even so with ganged condensers it is almost impossible to tune in more than one station with equally good quality resulting. With *separate* tuners it *is* quite possible to do so, and that is the whole matter in a sentence!

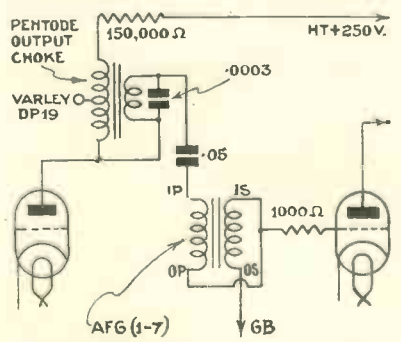


Fig. 6. The special coupling circuit described by Mr. Bonavia-Hunt

Here again a ganged tuner with a device enabling one to adjust the tuning of each coil separately will answer the purpose. The bandpass filter which seems to me to work best, providing the tuning condensers can be independently controlled, is shown in Fig. 2. Here the coupling condenser C_3 is of the differential type with a capacity of .0003, or a slow-motion midget air-dielectric condenser can be used. The rest of the components are self-explanatory, the customary bandpass coils being employed with their separate tuners.

Diodes and Distortion

We now pass on to the detector. I have personally stuck to the diode since 1928, though not to the usual form of circuit which is so commonly given in wireless periodicals. It is too often tacitly assumed that linearity between input and output volts is the only condition that need be insisted on and that such a detector is quite perfect. Alas, this is not so. I have come across several so-called perfect and distortionless detectors which failed to rectify all the frequencies uniformly. These were all of them diodes, so that I am afraid that the popular notion that the diode is a guarantee of undistorted rectification errs on the side of undue optimism. However, there *is* one particular diode that does fulfil the tests of linearity and straight-line frequency response, and that is the Westector. Those who adopt this can feel absolutely sure of distortionless rectification provided they use the correct circuit for coupling the detector to the first low-frequency valve. This circuit has already been published in the "Wireless Magazine" for August; but as no high-frequency stage was there given, and as those of my readers who are battery users will

be anxious to know how and where to apply grid bias, I am giving the necessary details in Fig. 4.

Here battery valves are shown with battery bias. If A.C. indirectly-heated valves with automatic bias are used, the circuit of Fig. 3 must be adopted. It is possible, of course, to substitute battery bias for the biasing resistances (and decoupling) shown in Fig. 3, in which case the condenser C_5 must be omitted and the arrangement shown in Fig. 4 adopted. I do not think that there is any question about the superiority of battery bias here. Automatic bias almost invariably succeeds in making the tone hard, even with 50-microfarad decoupling condensers.

Bias Costs !

The trouble is due to the introduction of the resistance between the cathode and earth, which is entirely avoided when the grid bias battery system is employed. Incidentally, one may be forgiven for mentioning the fact that a small $4\frac{1}{2}$-volt battery costs a very trifling sum and usually lasts a year; so that if quality of reproduction can be improved by the purchase and adoption of this small component I do not see why it should be so unpopular. Is it so absolutely necessary to follow the fashion ? Does not *tone* matter more ?

The Westector requires a minimum input of four volts, and the high-frequency amplifier must be capable of supplying this input. With a reasonably efficient outdoor aerial and one stage of high-frequency amplification this should be possible, but much depends on local conditions. In country districts there should be no difficulty, but in congested urban areas it may be necessary to add a second stage of high-frequency. I am of the opinion that it is better to do this than to change the detector.

With great care it is possible to maintain the standard of quality fairly well, using two stages, though I must repeat that there is bound to be *some* degree of deterioration. Fig. 5 shows this amplifier and requires no explanation beyond the fact that the screening must be most meticulously carried out in the customary modern manner, and that the condensers are best not ganged to give single dial control if more than one station is required. The rules enunciated for the design of the single stage must, in all other respects, be observed in each stage.

The low-frequency amplifier now engages our attention. I have already written so much about this part of our subject that I will be as brief as possible in discussing some further points in this connection. I am of the opinion that the low-frequency amplification of radio signals after rectification is best effected by two stages. The three-stage amplifier given in my article which appeared in the August number was intended for *both* radio and gramophone, but more particularly for the latter. This means that if we are designing a radio-gramophone we must either include an arrangement for switching out the intermediate low-frequency stage or else adopt a separate first valve and coupling for the pick-up only. I prefer the latter alternative.

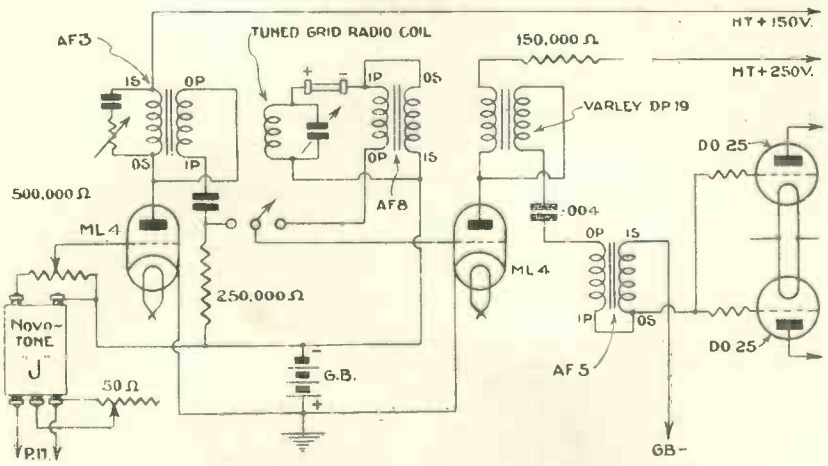
Now, if we decide on a two-stage low-frequency amplifier to follow our diode detector, it will be necessary to modify the coupling arrangement which I gave in my August article, and also it will be very desirable to choose the right type of valve for the first stage. I have a really wonderful coupling circuit for this purpose which is disclosed in Fig. 6. This is capable of amplifying all frequencies uniformly from 23 to 10,000 cycles, and it does not by any means cut off at 10,000. Considering that quite well-known components are used I think it is a veritable triumph. It can also be preceded by an additional stage of low frequency using the coupling shown in Fig. 2 of my article in the August number, but omitting the high-frequency choke coil there included.

Valve Selection

The question next arises: What valve shall we choose for the first stage immediately following the detector ? That entirely depends on whether we are receiving speech items or music. I have already stated that no really satisfactory volume control has yet been developed. It is quite absurd to expect the same valve to amplify both speech and music equally well. The ideal valve for speech reproduction is one that has an impedance of 2,000 to 4,000 ohms, and an amplification factor of 3 to 8. The AC/P1 or ML4 is therefore the right type here. But for musical items it is probable that such a low-mu valve would fail to amplify the rectified output sufficiently, and a valve of the AC/HL or MHL4 type would be indicated.

My suggestion is that we have both (connect the plates and heaters in parallel), and introduce a change-over switch to enable us to use which-ever we please.

The output stage will not differ in any respect from that recommended in my August article, and the arrangement there given for coupling the moving-coil and electrostatic speakers to the output valve or valves can be adopted with confidence. Those who are troubled with mains hum are recommended to connect a buffer condenser (value 2—.01 microfarad) across the primary winding of the mains transformer, and to take the centre tap to earth. It is essential also to avoid too close a layout of the components.



A FINE GRAMOPHONE AMPLIFIER

This is the theoretical circuit diagram of a low-frequency amplifier, particularly suitable for gramophone work. Three stages are available for gramophone and two for radio

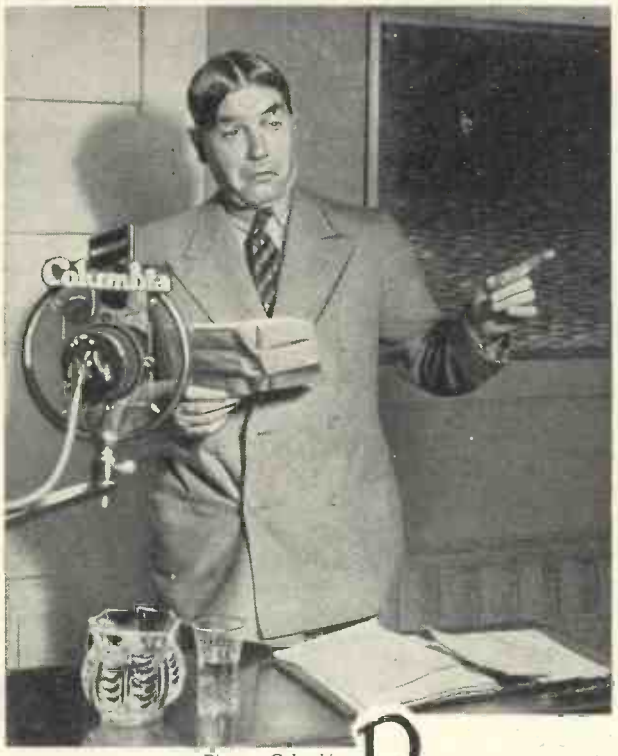


Photo: Columbia

Here is a very popular broadcaster who frequently appears in vaudeville programmes, John Tilley. He is now Chairman of non-stop shows at the Windmill Theatre and records for Columbia

Broadcast Music of the Month

By T. F. HENN

CHRISTMAS is coming and once again, so they tell me, there is feverish activity at Broadcasting House while they are thinking out more new and original ideas. They say that the Christmas programmes will be better this year. Well, the vaudeville and light entertainment departments have certainly made improvements this autumn, so there is hope.

At present there is only a brief outline of the major items in the Christmas schedule, but it is very easy to see that with carefully selected backing material, the programmes for the holiday should be miles better than we have had before.

In the week before Christmas we are going to hear a performance of Dicken's *Christmas Carol*, a repeat performance of Dumas' *Three Musketeers*, a Nativity play from St. Hilary, Cornwall, a regular annual event, and a special show by the Kentucky Minstrels.

Harry Pepper, who is arranging the show, told me that the idea of the Kentucky minstrel performance is to be on the lines of a Christmas party; in fact, I believe they are calling the show a "Christmas Party." He says that it will be an impromptu affair with Scott and Whaley as the leading lights. I still have memories of the wonderful show put up by the banjo quartet in the last broadcast.

There will be the two annual events on Christmas Eve, a carol service in the afternoon from King's College, Cambridge, and the Whitechapel service in the evening in which carols are sung by the Wireless Singers accompanied by members of the Wireless Military Band.

Sinbad the Sailor is the pantomime this year and it will be broadcast on both Christmas and Boxing Days. If present arrangements mature, the King will broadcast a message to the Empire after lunch on the twenty-fifth and in the evening Mr. Lloyd George will make the annual appeal for funds for the Wireless for the Blind Fund.

One thing is certain, the B.B.C. is going to make merry on Boxing Day. Old-fashioned dance music starts at 9.20 p.m. for a short time and this will be followed by Henry Hall in a special feature programme. Several other popular bands will be in the programmes. At present I am told it is intended to stop broadcasting at midnight on Boxing Night. This must be a mistake. It won't hurt the B.B.C., surely, to broadcast up to, say one or even 2 a.m. I can visualise many radiograms being put into action if this silly idea is carried out.

Jack Payne has arrived on the air with his new band. What do you think of it? I listened very carefully during its first show at the opening "Music Hall" and St. George's Hall at the latter end of October. Frankly, I thought it a great improvement on the old band. There is no doubt that towards its last days the old band had rather lost that virile feeling.

The new band strikes me as being an ideal organisation for stage work. There are many new names in the band. I noticed that Jack Simpson has taken over the drummer's job. He is one of the finest xylophonists in the country. Ronny Genardo, a wonderful mimic of Bing Crosby, gave a good account of himself during the first broadcast. I hope you noticed the playing of Curt Smith on the guitar. He comes to Jack's band from Dublin and, judging by his performance, he certainly knows his job.

I have always been a keen admirer of Jack Payne, and so have thousands more, and I do want to hear more of him on the radio. The B.B.C. can afford to pay him and there is no sane reason why they should not.

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So much for the light stuff. It will be a red-letter day on December 14 when Joseph Bonnet, the eminent French organist, pays his first visit to B.H. to play on the new organ. Nine p.m. is the time fixed. Bonnet, who was born at Bordeaux in 1884, is a pupil of the famous Alex. Guilmant. He has been invited to all leading European capitals to give recitals and received great



Here are three artists you all know. Our good friend Christopher Stone is on the left lighting up his pipe; Gabriel Toyne, the actor, is next with Yvette Darnac on the right

ovations during his tours of Canada and the United States.

Besides being a recognised interpreter of the organ works of Bach and Caesar Franck, Joseph Bonnet is an authority on earlier organ works.

It is almost certain that during his recital he will play some of his own charming organ works. His *Poemes d'Automne*, *Noëls* and *Legende Symphonique* are among the best of his own compositions. Don't forget the date; it will be a recital well worth hearing.

Photo: Columbia

One of England's greatest tenors, Ben Davies, who although seventy-five years of age, makes frequent appearances in London and West Regional programmes

By the time these notes are being read there will be only one more big symphony concert before Christmas. This is the performance of Beethoven's *Mass in D* (Missa Solemnis) on December 13.

A fine quartet of artists has been engaged for the work, which will be conducted by Adrian Boult.

There is a big joke about this famous Mass. Beethoven was commissioned to write it in the autumn of 1818 for the installation of the Archbishop of Olmütz, which was taking place on March 20, 1820. Beethoven retired to a quiet spot to write this and was known to shut himself up for hours in his room. Schindler describes a scene during the writing of the Credo in which he says that the master shut himself up in his room, singing, shouting, stamping, as if in actual conflict with life and death over the great fugue, *Et Vitam Venturi*.

He appeared twenty-four hours afterwards wild and dishevelled, faint with toil and his fast.

But the joke of it all is that it was not finished until February, 1823, and was delivered to his patron exactly three years late. It is a massive work and is well worth making a special note of hearing.

An item which will interest thousands of the admirers of Sir Walford Davies is a special recital of his songs on December 9 in the Regional programmes. Elsie Suddaby and Stuart Robertson are the artists and I should not be surprised to see Sir Walford at the piano.

Sir Walford was born at Oswestry and was knighted for his services to Welsh music in 1922. At the age of 13 he became a chorister at St. George's Chapel, Windsor.

Although we do not hear many of his own compositions over the wireless, he has written almost something of everything, from hymn tunes to symphonies. Besides his songs, his most popular work is undoubtedly that charming *Solemn Melody for Strings*.


Here are the two leading lights of the Monseigneur Dance Band. On the left is the popular Lew Stone and on the right, Al Bowlly, the vocalist

A fine tenor who took a leading part in the first British performance of Kalman's "Circus Princess," John Hendrik

Jonny Heykens, the famous Dutch composer of the "Second Serenade," has just made his first visit to this country. Here he is receiving a copy of Albert Sandler's recording of his favourite work

Photo: Columbia

His most famous songs are *Orpheus with His Lute*, *Follow Your Saint*, and *Never Weather-beaten Sail*. No doubt we shall hear at least one of these in this recital. Sir Walford, as you no doubt have guessed, is very fond of children and took special delight in writing music about and for them. One of his most popular songs is *When Childer Plays*, which is really a masterpiece of its kind.

Now don't forget to listen. It will be a delightful half hour of good music.

December shows promise of being one of the most interesting months of the year as far as "star" broadcasts are concerned.

Many of you will be glad to hear that Holt Marvell and George Posford's *Good-night, Vienna* is to be revived. It will be heard in the Regional programmes on December 6 and the Nationals on the seventh. I still think that this show was overdone when it was produced last year. I am still rather gloomy at the prospects of hearing that theme-song all over again. Anyway, it was a good tune and no doubt some of you will like to hear it.

I am always a keen listener to Continental relays. Another one is booked for December 8 from Vienna, this time. The concert will be given by the Vienna Philharmonic Orchestra, one of the finest combinations on the Continent.

Another relay will be that from the Café Collete on December 11. I think that joke has been exploded. Anyway, this idea of Walford Hyden's has taken on well. Everyone likes Café Collette.

If you like really serious music listen to a performance of Liszt's *Faust Symphony* on December 10. You will hear that the good Abbe Lizst can compose something entirely different to Hungarian Rhapsodies. It will be just as delightful, however.

And finally there will be another symphony concert by the London Symphony Orchestra which should be worth hearing on December 17. These relays from the H.M.V. studios at St. John's Wood are one of the bright spots of the new Sunday régime. I think the acoustics of this studio are really fine. There is no B.B.C. studio to touch it.

Three more famous dance-band leaders whose bands you hear every week. From left to right are Bert Ambrose, Henry Hall and Roy Fox of Kit Cat fame

THE SHORT-WAVE SEASON IN

WITH the change over from Summer to Winter Time, coinciding with the advent of autumn, and consequently longer nights, we may safely say that the short-wave season has begun and that conditions in general are favourable to good hunting. From now to the end of February is the best time to devote one's leisure hours to the search for distant stations on the lower channels. This pastime need not interfere with our daily listening to entertainments on the broadcast band, as experience has taught me that it is seldom the average household desires radio entertainments after 11 p.m.; this, as a rule, is just the time when the radio fan should settle down comfortably in front of his short-wave receiver to scour the ether.

On the Off Chance!

Unfortunately, many are under the impression that the capture of broadcasts on the higher frequencies is a difficult and wearisome task; possibly at some time or other an attempt has been made to pick up such transmissions; a set may have been borrowed from a friend or even specially constructed for the purpose, and the results have led to discouragement. The point is that most disappointments are caused through the fact that the amateur does not take *time* into consideration, or, alternately, in the hope of hearing something, twirls the condensers aimlessly on the *off chance* of picking up a carrier wave.

Most short-wave stations are still of an experimental character, and in view of this they may seek favourable channels and change their frequencies from time to time; in addition, their time schedules are subject to *frequent* alteration, and consequently it is essential to be in possession of the latest information regarding the working of the transmitters. It is not because a few turns of the dial do not produce the wanted signal that the signal is not there: careful tuning on these higher frequencies is necessary and, what is more, a search at the right period of the day or night. Make a point of assuring yourself that your list of stations is correct in respect to wavelength, etc.; keep it strictly up to date from the information regularly published in "Wireless Magazine"; failure to do so may result in your trying on many different occasions to tune in a station which is off the air. If quick results are desired try first for the most powerful stations such as Moscow, Oslo, Skamlebaek, Zeesen, and so on. Tune in carefully and log the condenser readings exactly, thus giving you definite landmarks (with establishment of wavelengths and/or frequencies) on the scale.

Moscow on 50 metres may always be heard between G.M.T. 18.00 and 21.00; sometimes you will find it working from 16.00, but seldom later than 21.00, which equals midnight in that part of Russia. Skamlebaek, relaying Copenhagen on 49.4 metres, works from 18.00 nightly until 23.30, in the course of a few weeks it may be carrying out night transmissions between midnight and 03.00 for the benefit of Danes resident in oversea countries.

Since the Summer

The times for Zeesen DJB (19.737 metres), DJD (25.51 metres), DJA (31.38 metres), and DJC (49.83 metres), have not suffered much alteration since the summer months. Make a note of them: DJB, 12.55-21.30; DJA, 22.00-02.00; DJD, not regular, 15.00-24.00; and DJC, usually from midnight to 02.00 G.M.T. Zeesen is a powerful station easily receivable in the British Isles. Apart from the fact that the broadcasts are in the German language, you may recognise the English news bulletin given at 14.00 and 21.00 through DJB, at 23.00 through DJA, and again at 01.45 through DJC.

Jelöy (LCL) which takes the Oslo programme, is still in an experimental stage; the wavelength is not definitely fixed, but at present it is using 42.92 metres: it is usually heard in the earlier part of the evening between 18.00 and 21.00.

From Poznan

Another European transmission which is a good one is that from Poznan (SR1), which, following a complete overhaul resulting in increased power, is now again working on 31.6 metres. So far the tests have been carried out on Tuesdays and Thursdays between 17.30 and 19.30 G.M.T., but very shortly more

COMPONENTS YOU WILL NEED FOR THE 5-METRE TRANSMITTER

CHASSIS — £ s. d.
1—Peto-Scott, consisting of baseboard, 18 in. by 12 in., and side supports (two), 18 in. by 3 in., and (two) 11¼ in. by 3 in. 0 4 0

CHOKES, HIGH-FREQUENCY
4—Igranic short-wave, type [illegible] 0 8 0

COILS (Materials for making)
4 ft. No. 14-gauge round copper (Lewcos) 0 0 2
8—Clix solid plugs, type No. 10 0 1 4
8—Clix insulated resilient sockets, type No. 11 ... ... 0 1 8

CONDENSERS, FIXED
1—Dubilier .0003-microfarad type 620 ... ... 0 1 3
1—Dubilier .0005-microfarad type 577 ... ... 0 7 6
1—Dubilier .001-microfarad, type 577 ... ... 0 7 6
2—Dubilier 2-microfarad, type BB 0 7 0
1—Dubilier 2-microfarad, type LSG 0 12 6

CONDENSERS, VARIABLE
4—Stratton .000035-microfarad, type 900 ... ... 1 0 0
2—.0001-microfarad, type 900 ... 0 13 0
1—British Radiophone two-gang .00017-microfarad short-wave type 612 ... ... 0 17 6

DIALS, SLOW-MOTION
3—Igranic Indigraph with micrometer adjustment 1 2 6

HOLDERS, VALVE
4—W.B. five-pin type, skeleton 0 2 0

RESISTANCES, FIXED
1—Bulgin, typePR, to suit power amplifier 0 2 6
2—Dubilier 400-ohm 0 2 0
1—Dubilier 5,000-ohm 0 1 0
1—Dubilier 50,000-ohm 0 1 0
1—Dubilier 150,000-ohm ... 0 1 0

RESISTANCES, VARIABLE
2—Claude Lyons 30-ohm humdingers 0 5 0

SUNDRIES — £ s. d.
4—Stratton condenser-mounting brackets, type No. 937 ... 0 4 0
2—Stratton ebonite extension rods, type 925 ... ... 0 5 0
1—Stratton ebonite extension rod, type No. 926 ... ... 0 3 0
9—Stratton erinoid pillars, 1½ in. long, for mounting condensers and coil holders ... 0 1 4
4—Peto-Scott ebonite strips, 1¾ in. long by ⅝ in. wide ... 0 0 8
1—Peto-Scott ebonite strip, 3 in. long by 1½ in. wide ... 0 0 3
3—Peto-Scott ebonite strips, 8 in. long by 2¼ in. wide ... 0 2 3
2—Igranic jacks, type P72 ... 0 3 0
2—Igranic universal plugs ... 0 2 6
Connecting wire, 20-gauge round tinned copper (Lewcos) ... 0 0 6
Oiled sleeving (Lewcos), say ... 0 1 0

TERMINALS
9—Belling-Lee, type B, marked: (four) L.T.A.C., H.T.—, H.T.+1, H.T.+2 two plain 0 4 6

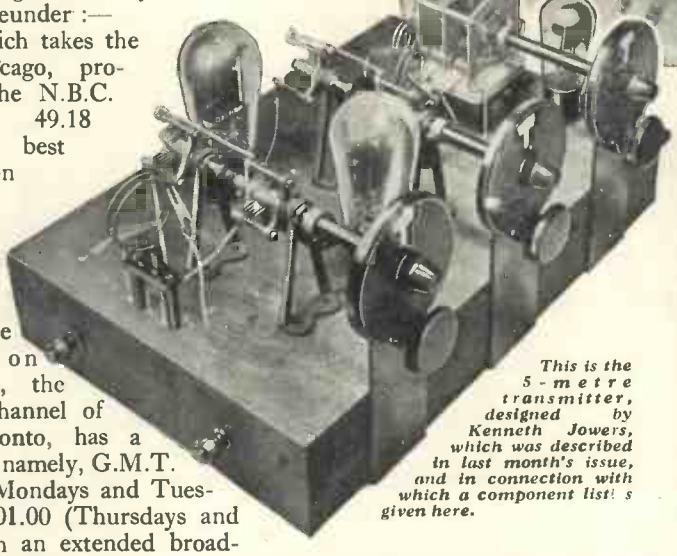
FULL SWING!

time will be devoted to them. Announcements are usually given out in Polish and French.

Of transatlantic short-wave stations there are a great number, as you may see from the lists published both in the "Wireless Magazine" and *Amateur Wireless*.

Between the 40-metre amateur transmitter band (41.1-42.9 metres) and 50 metres after 22.00 or 23.00 you should be able to log several. In some instances the times have been changed and they are given hereunder :—

W9XF, which takes the WENR, Chicago, programme of the N.B.C. Network on 49.18 metres, is best sought for on Sundays between 20.30-23.00, or 01.00-05.00; VE9GW, Bowmanville (Ontario) on 49.22 metres, the short wave channel of CKCW, Toronto, has a new schedule, namely, G.M.T. 13.00-17.00 (Mondays and Tuesdays); 21.00-01.00 (Thursdays and Fridays); with an extended broadcast until 05.00 (Saturdays); and on Sundays between 16.00-02.00. To hear the CHNS, Halifax (Nova Scotia), transmissions, you must tune in VE9HX on 49.10 metres between G.M.T. 22.00-03.00; they take place daily. A gong interval signal is used; it consists of four notes and precedes the call, in which a reference to the Maritime Broadcasting Company, of Halifax, is regularly made.



This is the 5-metre transmitter, designed by Kenneth Jowers, which was described in last month's issue, and in connection with which a component list is given here.

Spanish Signals

If just below this dial position you should hear Spanish, it will be YV1BC, Caracas, on 49.08 metres. There are two separate sessions, 16.00-18.30 and 22.45-03.30 daily; on Sundays from 19.30-03.30 only. Here we also hear four chimes between items.

Another Venezuelan broadcast of which reception is often reported is YV3BC, also from Caracas. Times: G.M.T. 15.00-18.00 and 21.00-02.00 daily; tests are also made on 31.55 metres (9,510 kilocycles) on Sundays between 02.00 and 03.00. The call includes the words *Radio Difusoria Venezolana*, and some announcements are put out in the English language.

I was under the impression that a five-metre transmitter would be of little interest, except to those already holding a transmitting licence, but it appears that I am very much in the wrong. Since last month, when the five-metre transmitter was described, I have come to the conclusion that this type of transmitter has a much wider appeal than I at first realised, particularly abroad where in some countries a licence is not necessary and the other where they are very easy to obtain. In view of these facts I feel that it is necessary to go more fully into the component that are used, for the benefit of those who are not acquainted with ultra short wave transmitting.

I have heard of several interesting duties to which this type of transmitter can be put. For example, in Africa, particularly in the mining areas, telephonic communication is not always convenient, so that native runners are employed. Although the distance may only be a few miles, this means a considerable loss of time. In such circumstances a five-metre transmitter becomes very useful. It can be made comparatively directional, is not troubled by atmospherics, can be erected with the greatest of ease, and will give as good results as a normal telephone system without any of its deficiencies.

That it will be useful in heavily wooded country over distances up to four or five miles does not have to be stressed, and its utility in other spheres is quite obvious.

Important Parts

The components in an outfit of this kind are of vital importance, and in the majority of instances those specified will have to be used as they have been made specially for the purpose, and are almost unobtainable from other manufacturers. Of course, abroad other components can be used, providing they have similar characteristics.

The most difficult components to obtain are the variable condensers which are used for tuning and neutralising. The single condensers are all obtainable from Messrs. Stratton, who specialise in this type of component. The double-gang condenser is a special one obtainable from Messrs. Radiophone, but this is also available from Messrs. Stratton.

"LINING UP" THE GANG

by MARCUS G. SCROGGIE, B.Sc., A.M.I.E.E.

BY way of compensating, perhaps, for the less elegant expressions such as "Oh, yeah!" and "Sez you!" America has exported to us some others that are really apt and useful. One of them is "lining-up." It would be difficult to improve on this as a description of the process of adjusting a number of circuits so as to be in tune with one another at every setting of the gang condenser.

Screwing Trimmers!

But as regards the practical carrying out of the process itself there is often less clearness of thought. Perhaps you consider there is no need for thought; that it is just a matter of screwing trimmers in and out until you get the loudest noise. That may be all right until you tune to another station; and then, when you find you have to start trimming all over again for it, you begin to wonder.

It is not proposed, then, to offer any vestige of apology for explaining that there are no less than three separate conditions that must be satisfied before a tuned circuit is lined up. These are: (1) the inductances of the coils must be equal, (2) the variable parts of the condenser gang must be equal at every position throughout the scale, and (3) the initial capacities—wiring, minimum capacity of tuning condenser, valve electrodes, etc.—must all be equal. If the coils are wrong to start with, no amount of jugglery with condensers or trimmers will avail to set things right at all wavelengths, however much it may appear to succeed at any particular point.

Yet it is true that the wavelength to which a circuit is tuned can be shifted by altering either capacity or inductance. In fact, although capacity tuning has long been almost universal, inductance tuning may quite conceivably supplant it. So, before going on to consider how ganging is carried out in practice, let us make quite sure that we understand exactly why the two adjustments are not interchangeable at the matching stage of the proceedings.

The wavelength of a tuned circuit—that is to say, the wavelength to which it is most responsive—is proportional to inductance multiplied by capacity. Perhaps you know the famous old formula: wavelength = $1885\sqrt{LC}$. It doesn't matter to the wavelength what L (the inductance) is, or what C is, individually, so long as the two multiply up to give the same product. A 250-microhenry coil with 400 micro-microfarads (0.0004 microfarad) across it tunes exactly to the same wavelength as a 500-microhenry coil with 200 micro-microfarads. The two arrangements are not quite equivalent in some other respects, but they are as regards wavelength.

Now, when you tune over a band of wavelengths—say, 1,000 to 2,000 metres for ease of calculation—the product LC must be increased *fourfold* (you remember the square-root sign in the formula). If you start off with a 4,000-microhenry coil and 70 micro-microfarads, you can adopt capacity tuning and increase the capacity from 70 to 280, or you can cover the same band with inductance tuning (the new "permeability" system, for example) by increasing the inductance up to 16,000. Or, for the matter of that, a mixed system in any proportion is quite conceivable; doubling both quantities would achieve the same result. (By the way, if you have taken the trouble to work these quantities out by the formula and find it gives a wavelength of 1,000,000 metres, don't suspect all sorts of things; the formula is for C in microfarads, whereas we happen to be using micro-microfarads just to avoid the awkward decimals.)

Condenser Ganging

To proceed: condenser tuning is still the standard method, and will be assumed until further notice. We shall also assume two tuned circuits that are to be gang-tuned. Each unit of the gang condenser has been adjusted by the manufacturer to give an increase of 210 micro-microfarads (to take the figures relating to the imaginary case just mentioned). If he has done his job properly, the increases at all intermediate points of the scale are also equal for both units, within a very small percentage. It is generally such a troublesome business for the amateur to match a condenser that it is best to buy a reliable make and to take good care that it doesn't get knocked out of adjustment.

Suppose, however, that you have not been so fortunate with the coils and that, whereas one is a correct 4,000 microhenries, the other is

10 per cent. low. You now proceed to fix everything up and try the tuning on a station. The second circuit is not quite in tune, so you screw the trimmer in and out until you get it correctly adjusted. When that has been done and both circuits are dead in tune, the capacity in the second circuit is 10 per cent. high, to compensate for the unmatched coil.

The Second Stage

So far, all seems to have gone beautifully. But now tune in another station. To do so the condenser is turned one way or the other, altering the capacity. What was a 10 per cent. excess of capacity is now no longer so. If the first test was done with 100 micro-microfarads in circuit, the trimmer addition to compensate for the coil was 10. But if the next station requires 200 micro-microfarads to tune it, the 10 per cent. amounts to 20 micro-microfarads; so there is now a shortage of 10, and more trimming is required.

So we see that the only chance of getting both circuits in tune at every setting of the condenser is to have both coils accurately matched. It must be remembered, too, that they must be matched with any screens or other neighbouring metal in position. Again, a reliable product is called for.

Some idea of the accuracy that is necessary for ganging may be judged by considering that a 300-metre wave is 1,000,000 cycles per second. So 1 per cent. of this is 10,000 cycles. To tune within 1 per cent. both coils and condensers must be within 1 per cent. of the correct figures (giving a possible error of 2 per cent. on both of them taken together). But it isn't enough to be within 10,000 cycles: the next station is only 9,000 cycles away, according to the European wavelength allocation. Matching within 1 per cent. is not good enough for selective tuning.

Ganged Chassis

Proper ganging, then, is very difficult unless one can cast the burden of coil and variable condenser on the manufacturer, who, if a firm of substance, has the equipment necessary for doing this work easily and accurately. All that remains to be done on the spot is to equalise the starting-off capacity by adjusting trimmers. The various incidental capacities due to wiring, valves, coils, etc., are highly unlikely to total up to the same in each circuit; hence the need for trimmers.

The general method of adjusting these is to tune to a convenient transmission, getting the loudest reception with the variable condenser alone, and then trying each trimmer in turn to get a still better result. There are several practical points to notice. If a powerful station is selected for the purpose it is very likely that considerable manipulation of one or more trimmers will be possible without noticeably affecting the strength of reception.

If the same thing is true even when a more distant and therefore critically tuned station is received, then either the circuit is hopelessly out of tune (as might be the case with a faulty coil or with a large aerial connected straight on to it without an intervening series condenser of low capacity) or it is very unselective. Now, from what has gone before, it should be clear that a small added capacity has the greatest effect when the capacity as a whole is at its minimum. That is why a station near the low-wave end of the condenser scale is always recommended for trimming purposes. There should then be no difficulty in getting a distinct maximum response at a particular setting of the trimmer.

Another possible reason for not getting this is that there may not be enough adjustment in the trimmer to reach it. If the strength of reception is still on the increase when the trimmer is as far as it will go, then the main condenser knob should be shifted round a little in the direction the trimmer *wants* to go.

It is possible that when you have done that the other trimmer is hard up in the opposite direction. If a situation exists in which one trimmer is hard up against maximum, while the other is fully unscrewed to get the best results, and the coils and condenser are above reproach, then evidently one of the tuned circuits (the one with the trimmer unscrewed) is loaded up with some excess stray capacity—perhaps an armoured lead, an unduly long connection, or an aerial tapping too high up the coil.

Tuning Range

Having put that to rights, or not having run into any such trouble at all, you are now able to get a distinct maximum reception by adjusting each trimmer. Perhaps now you find difficulty in tuning down low enough in wavelength. That may be a result of having an unnecessarily large proportion of trimmer capacity in both circuits. The cure is to reduce the capacity of each one by the same amount, which is accomplished by *increasing* the main tuning capacity slightly and then re-trimming. If this is done properly, one of the trimmers will be very near its minimum or fully unscrewed position.

Having done this successfully for a low-wave station, the same adjustments should hold good over the upper reaches of the condenser scale. If not, either coils or condenser aren't all they have been cracked up to be. You will have to take a leaf out of the book of the politicians and adopt a compromise!

Then there is the long-wave band. The variable condenser does not, of course, suffer any mysterious change on switching over; so, if it was right on the medium band, it should still be right. But the wave-change switch is now "live" and contributes a quota of stray capacity which would, for perfect ganging, require a different trimmer adjustment.

CATHODE-RAY TUBE CHECKING

In commercial-set tests a cathode-ray tube with a suitable time base gives an accurate picture of the set output and enables the ganging to be accurately done

Depth Sounding

(Above) A Marconi Echometer installed on the bridge, and (right) the Echoscope for investigating the sea-bottom

RADIO has increased the safety factor of shipping with direction finders and automatic S O S transmitters. Now navigation is being made easier by the introduction of a device known as the Echometer which is used for depth sounding by means of a high-frequency beam.

The Echometer Sounding Device, as its name implies, is an automatic device for ascertaining the depth of water under the ship. By means of this instrument a ship is able to send out through the water to the sea bed a continuous series of focused high-frequency rays or beams after the fashion of a searchlight. The Echometer measures the time taken by these beams to travel to the ocean bed and return. By merely pressing a button and looking into the instrument the navigator is shown the exact depth of water under keel and the nature of the sea bottom over which the ship is passing is also indicated.

The Echometer is instantaneous in action, simple in design and operation, and silent so that it does not disturb the passengers and personnel on board the ships on which it is installed. It works from a 4-volt accumulator battery, and no power is required from the ship's mains when soundings are being taken. There is only one hull casting to accommodate the projector, transmission and reception being effected by this single unit which is only about one foot in diameter.

The Echometer can be operated simultaneously with the wireless direction finder without causing interference.

The deep sea type Echometer reading up to 720 fathoms under keel is fitted in deep-sea halibut-fishing craft and whaling vessels. When fishing halibut banks, such as those off the Greenland coast, the skipper of a line-boat can, by means of the Echometer, place his lines—which are often twelve miles in length—at the exact depth at which experience has taught him the finest halibut will be found; while whaling fleets make use of the Echometer in order to base their operations in the vicinity of the deep sea banks where the whales feed.

The Standard Echometer, when fitted with a 360 fathom scale, is carried in more than 400 British steam trawlers and line-fishing vessels and is used on fishing banks from the White Sea to the Faroes and from Iceland to the Scilly Isles. With this instrument the trawl-skipper is able to trawl on the edge of a bank with ease and precision, and to locate and fish those hollows and depressions in the sea bed where the most sought after fish are known to congregate.

The standard Echometer is fitted with a 160 fathom scale. The navigator, proceeding at full speed, has only to press a button and glance at his Echometer to be shown the true depth under his keel, repeated many times a minute, as well as the nature of the sea-bottom. Thus he is enabled to navigate by chart position with ease and confidence in conditions of low visibility, and he is relieved of much of the mental strain and anxiety of bringing a ship into port in unfavourable weather.

For coastwise shipping and the smaller fishing craft there is the 90 fathom Echometer. If the need of timekeeping is great in seagoing ships it is still greater in the coastwise trade where, to miss a tide may mean a day's delay.

In addition to giving instant depths under keel and locating, in terms of direction and distance, submerged submarine objects on the sea bed such as rocks, reefs and wrecks, the Echometer also indicates by mid-water echoes the presence of shoal of fish.

Although the Echometer is a complicated piece of apparatus so far as the design is concerned, it can be operated by navigation officers with no radio technical experience.

The whole meter is absolutely stable as the emitted high-frequency beam is controlled by an oscillating quartz crystal. The high-frequency oscillator in contact with the water is excited thirty times a second in the

by Radio

case of the 720 fathom model (sixty times a second for the other types) by a quench spark high-frequency generator.

The crystal action is reversible and so the transmitter is also used to detect the echo. Only one spark is used for each emission, so that there is no interference with the returning echo.

The crystal oscillator has a frequency of 37.5 kilocycles per second, and in salt water this produces a wave about 4 centimetres in length. An 8-in. diameter quartz oscillator is used between steel desks. This "projector" is fitted to the bottom of the vessel and projects a reasonably directional beam. A layer of piezo crystals fitted together in mosaic form is sandwiched between steel discs. The whole assembly is constructed so that its thickness is half of the wavelength at its resonance frequency. Considered electrically, the quartz assembly is a condenser the lower surface of which fits flush against a steel plug through which the vibrations are transferred to the water without frequency change.

The transmitter is built up like an ordinary miniature quench spark arrangement, and is driven from a 4-volt accumulator. This same accumulator also provides the filament current for the receiving amplifier, the high tension of which is provided by a dry battery. There is one master switch which closes the primary circuit of the transmitter step-up transformer, switches on the valve filaments and the scale illuminating lamp of the oscillograph and starts a clockwork motor for the optical mechanism.

Where the depth sounder can be fitted close to the quartz oscillator arrangement then direct leads are taken from the spark transmitter to the quartz assembly. If the leads have to be long, however, a double wire feeder system as used in ordinary transmitter practice connects the spark transmitter with the quartz crystal assembly.

NORTH SEA TYPE DEPTH SOUNDER

This is a special type of depth sounder produced by the Marconi Sounding Device Co., Ltd. In all the Echometers a focused high-frequency beam is used for depth sounding

The receiving amplifier is coupled to the main tuning circuit of the transmitter, so that it picks up the echo as well as the transmitter signal. The first valve stage of the amplifier is a bright emitter so adjusted that it bears the brunt of the transmitted signal and protects the following stages.

In all there are five stages, resistance coupled. The output is a grid current rectifier, which is coupled by a transformer to the output stage.

The optical system comprises an oscillograph and a clockwork ratchet wheel arrangement so that each emission and each return of the signal makes the light spot move in a vertical direction by operating the reflecting galvonometer. A swinging mirror makes the light spot traverse the scale horizontally at a predetermined speed. The fathom scale is very clear to read, as can be seen from the accompanying photographs of two types of Echometers.

BUILDING RADIO DEPTH SOUNDERS

Putting the finishing touches to a bank of Marconi Echometers for installing in the navigational equipment. These meters are built up in the same manner as chassis-built radio sets

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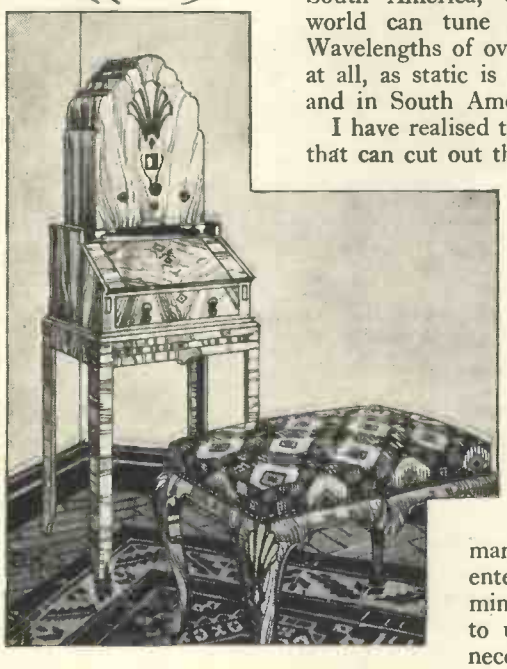
This same method of marine depth sounding can be applied to earth investigations and aeronautical height measurements. In next month's issue a technical description of the systems used by surveyers and aeronautical engineers for height and depth measuring by radio will be given.

Are American Ideas

by an American Set Exporter



FOR many years I have been handling radio sets for export all over the world, as well as for our home market. It has become a necessary habit to compare our sets with those manufactured by foreign competitors.

I have come to the conclusion that our American sets are so far ahead in receiver design and marketing that the rest of the world will have to take a street car to catch us up.

I know that we have distinct geographical advantages over Europe, but even so, our radios are definitely more suitable for their job than the average English counterpart. Our climatic conditions, which are sometimes Arctic and at other times tropical, are a distinct asset to our set designers. Every receiver must be designed to operate under all sorts of conditions, so that each and every set is automatically suitable for export as well as home use. This is a big advantage, as we only have to concentrate on one type of set.

Almost every American radio set can tune in short wave stations, down to about 25,000 kilocycles, so that American Nationals in South America, Cuba, or any part of the world can tune in to the home stations. Wavelengths of over 500 metres are of no use at all, as static is too bad on the West Coast and in South America.

I have realised that a successful radio is one that can cut out the local stations—sometimes about twenty or thirty of them in a town—and at the same time tune in West Coast stations 3,000 miles away. Such a set must have a highly efficient radio frequency side, and use a super-het circuit to give six to eight kilocycle selectivity.

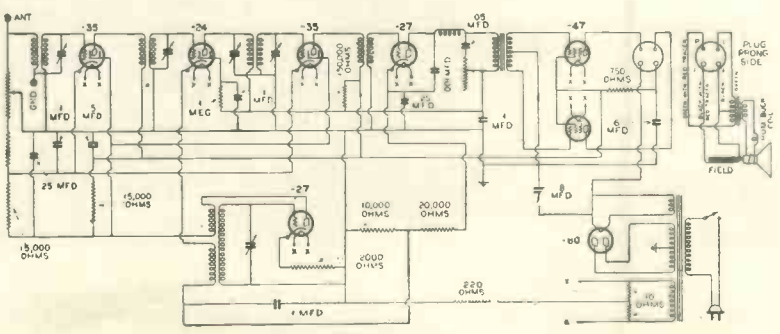
Nobody wants to listen to long-distance stations if they fade or are difficult to hear. The average man wants programmes and entertainment, and he doesn't mind how many valves he has to use, or what sort of set is necessary to do the job. Consequently, to take care of poor localities and steel-constructed buildings, ten- or twelve-valve sets with powerful audio stages are essential.

Then the housewife must be considered. She wants an easily tuned set, in a pretty cabinet—so she gets it. Nearly all our radios have single-dial control, visual tuning and quiet automatic volume control to stabilise those long-distance stations. It is mainly because of the housewife that the most popular cabinet is the tall-boy disguised to look like a bureau, or some other piece of furniture, rather than a radio. Of course every set is fitted with a phonograph socket, or is complete with phonograph motor and a powerful audio-frequency stage for reproducing phonograph records.

I consider that the average English radio has far too small an audio stage. We over here use our phonograph for dancing at parties, so that we want plenty of volume, that is why most of our sets give between four and five watts as a minimum.

It is quite obvious that if any money is to be made out of radio, I mean the manufacturing side, the production costs have to be down to rock bottom. To do this we have realised that more valves, but perhaps less efficient ones, allow for sets to be turned out like peas. This knocks down the testing costs, enables the components to be made more cheaply and more consistently, so that the average price of our radios is under half that of our foreign competitors.

Our export trade is far in advance of the English. This is perhaps due to price, or to our complete servicing methods. But there is one point which must be admitted. If a valve or a component goes wrong in an American radio set, a replacement can be bought from any radio store without worrying who made it or whether it will be suitable. All our valves and components are standardised, which is more than you can say !



THE AMERICAN IDEA
This complete circuit layout of a Crossley receiver is a typical American example. Note the mains drive arrangements and the fine low-frequency section

Better—or Ours?

by a British Set Designer

A VERY clear argument has been put forward in support of American mass-produced sets with high-sounding specifications, but I feel sure that the wireless industry is simply a repetition of the motor-car trade.

The American motor car is usually a high-powered petrol eating monster of between six and sixteen cylinders and up to about 50 h.p. The high speed and colossal acceleration is often gained by virtue of sheer power rather than good engine design. Now as compared with these the English family car has usually between four and six cylinders, and is between 9 and 15 h.p. The wonderful engine performance is obtained by means of clever design, and the running costs, which are infinitely less, are more in keeping with the dismal financial state of the world!

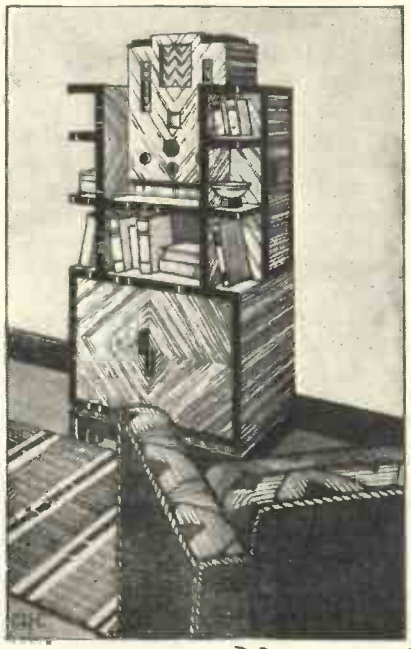
The Americans are fond of noise, bustle and advertising—they think it means sales. They don't consider the point that sets can sell themselves by outstanding performance. So we hear of monster "fourteen-tube" sets with three or four radio-frequency stages, one or two push-pull stages and colossal twin speakers of the auditorium type.

Is this the type of set wanted? I feel that a well-designed six- or seven-valve superheterodyne, with each valve pulling its weight is a much more sensible proposition. Many American sets are notorious for their boomy reproduction, which would not be tolerated by the average Englishman. That is why, from start to finish, an English receiver is a carefully designed instrument, designed not only to obtain maximum efficiency, but to meet with requirements of the people who are going to use them.

Climatic conditions do have a big effect on receiver design. For example, the much-debated long waves. In Europe, where atmospherics do not affect reception to any great extent, long-wave stations provide a very reliable service over long distances. Short waves are not very popular; for who can imagine anyone wishing to do knob twiddling early in the morning, when the more important short-wave stations come over.

The English sets do what the English public want them to do: bring in a fair number of stations without any trouble, but with good quality. Long technical specifications which are supposed to give remarkable performances leave the Englishman stone cold. He wants results, and obvious ones.

Our American critics will agree that the British broadcasting service is on a level of its own. The amount of advertising in connection with our sets suitable for the Colonies is negligible, but in spite of this Colonists are buying more and more British-built short-wave sets for tuning in to the English stations. These sets are sold on performance,



and performance alone, not high-speed advertising.

In every industry, including radio, the English designers take a pride in obtaining the absolute maximum efficiency. Our valves are sometimes two or three times as efficient as the nearest American equivalent. Our workmanship and construction are infinitely cleaner, while the receivers are obviously built to last, so that the slightly higher prices really mean a saving in cost, in the long run.

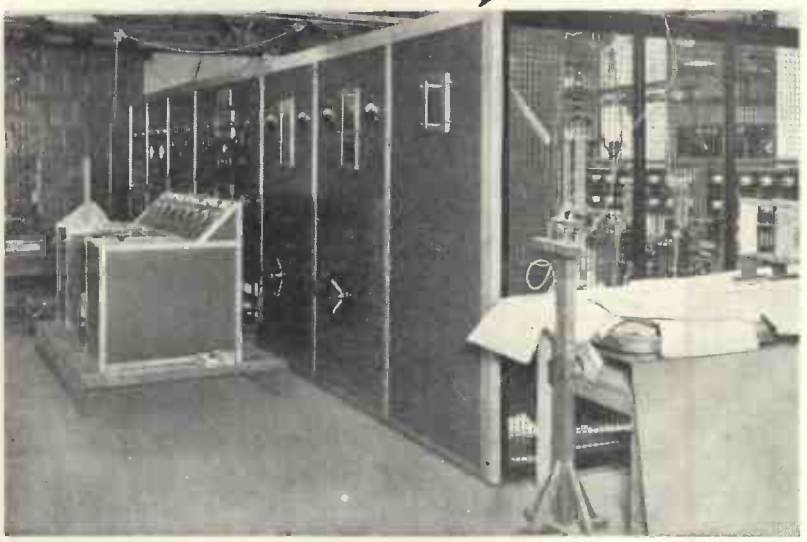
While cabinet design is not so ornate as that of the Americans, the comparatively simple design, but sound workmanship, is more in keeping with British traditions. The English receivers look like radios and are distinct assets to any household.

Perhaps the biggest difference between English and American radio is in the low-frequency stages. I know that the average American set gives at least four or five watts output, as compared with the one or two watts from the average English set. These differences can perhaps be attributed to mentality. I have already mentioned the American love of noise and bustle, so that a loud set which can be heard half way up the road is considered as good advertisement. Compare this with the peace and quiet of an average English household.

Radio·at Cape Town

MILNERTON, where the new Cape Town station is, is just about 15 miles north of Cape Town. This is because of the usual difficulty of accommodating aerials in the crowded parts of the city and also to prevent a local wipe-out from the 10-kilowatt transmitter.

Inside the neat transmitter building of Radio Cape Town is a cage-like affair with seven panels in front which carry the main controls. Behind, and protected by the wire cage, are the tuning circuits, the intermediate valves and the four final big water-cooled valves. The seven panels comprise a switchboard which carries all the measuring instruments. There is an expanding safety gate at the side of the switchboard with the usual interlocked safety catch and relay.



There is a control desk opposite the seven panels of the transmitter, and this is familiar because it is made after the same design as those at the B.B.C. main regional stations.

Wheels on the front of the three main panels of the transmitter are used to control the tuning circuit. Radio Cape Town can be adjusted to work on any wavelength between 200 and 545 metres. The working wavelength is 375 metres, which is practically the same as that of the old Cape Town station.

On the studio cables there is a speech amplifier. Low-power series modulation is used at Cape Town. There is no wavelength wobbling, as the engineers have gone out of their way to prevent frequency changes. Even in Cape Town there is considerable difference between the day and night temperatures and so, by a very ingenious device, the engineers have arranged that *any expansion or contraction of the metal parts of the tuning circuit are automatically compensated*, so that the working wavelength doesn't vary. The Cape Town transmitter is not crystal-controlled, but is driven by a master oscillator followed by a harmonic selector. There are the usual valve stages stepping up the power (large air-cooled bottle valves) and the final stage consists of water-cooled valves behind the last panel but one.

The actual power output according to our rating is 10 kilowatts. You might think that more power than this would be needed to cover the immense distances with which one has to cope in Africa. But limitation of the power is necessary as any service-area ring near or around Cape Town covers an area of about three-quarters of water. In any case, it is estimated that most listeners are within forty miles or so of the centre of the city and the only point of the new Milnerton broadcaster is to provide a more even service area. This fact—three-quarters of the area being water—is a striking sidelight on the licensing system which has been in force and which has provided the money for the new Cape Town station.

The scheme for charging £1 15s. for licences for sets used within 100 miles of the station, £1 5s. for sets up to 250 miles, and a flat rate of £1 for sets outside that area has built up a fairly healthy revenue. The old licensing flat rate was only the equivalent of 5s. to 7s. 6d.

The four final water-cooled valves at Radio Cape Town need over 12,000 volts high tension. To keep the running costs as low as possible, the Cape Town engineers have dispensed with motor generation. They take their high tension by direct rectification of the three-phase power supply by means of valve rectifiers. These new thermionic rectifiers are water-cooled.

This photograph shows an outside broadcast being carried out at Cape Town from the top of the famous Table Mountain. The heading photograph shows the Cape Town transmitter undergoing tests at the Marconi works

Igranicor Short-wave Coil :: Amplion High-frequency Choke :: Belling-Lee Disturbance Suppressor :: AvoMinor :: Utility "Mite" Condenser :: Cosmocord Universe Pick-up

IGRANICOR SHORT-WAVE COIL

APPARATUS : Short-wave coil.
PRICE : 12s. 6d.
MAKERS : The Igranic Electric Co., Ltd., 149 Queen Victoria Street, London.

THE first iron-cored short-wave coil to be placed on the market is that made by Igranic Electric Co., Ltd. In appearance this coil is similar to the standard medium-wave iron-cored coil made by this company. The iron core is of the laminated type and a complete circuit is employed. A moulded bakelite base carries the coil assembly and the terminals, and also houses the wave-change switch, which is entirely satisfactory in operation. A metal can is also provided which is automatically earthed when in position. The operating spindle of the wave-change switch is arranged so that its length on either side can be easily adjusted, thus facilitating ganging with the broadcast-band coils for all-wave receivers.

Igranicor short-wave coils are the first iron-core short-wave tuners to be placed on the market

The coil is rated to cover the wave band from 15 to 80 metres in two steps, but on test the actual range was found to be 19 to 76 metres, the two steps being 19 to 35 and 35 to 76 metres. In operation with a two-valve detector L.F. receiver, the coil was most satisfactory, the reaction being smooth and constant over the range.

AMPLION HIGH-FREQUENCY CHOKE

APPARATUS : High-frequency choke.
PRICE : 4s. 6d.
MAKERS : Amplion (1932), Ltd., 82-84 Rosoman Street, E.C.1.

THIS is one of the best high-frequency chokes which we have tested for some time. The binocular type of construction is employed and the windings are accommodated in slotted ebonite formers housed in a black moulded bakelite casing. The terminals are hexagonal headed with screw slots, and are reversible so that the choke may be wired into circuit by either under or over baseboard connection.

The performance of the choke over the normal working range of 200 to 2,000 metres was tested and no resonances are apparent. The effective self capacity is approximately 6 picofarads.

This choke can be recommended for all uses with the possible exception of the intermediate-frequency amplifier of super-heterodynes.

BELLING-LEE DISTURBANCE SUPPRESSOR

APPARATUS : Disturbance suppressor.
PRICE : 9s. 6d.
MAKERS : Belling & Lee, Ltd., Arterial Road, Enfield.

MOST readers are familiar with the annoying clicks and bangs and other electrical disturbances which are picked up on a modern radio receiver when it is in a sensitive condition, as when receiving foreign stations Many of these noises can be cut out by the use of a component such as the Belling-Lee suppressor. This includes two high-voltage condensers mounted in a neat moulded bakelite case, together with two fuses. The fuses are standard 1-ampere Belling-Lee type and are included as a safeguard in the event of eventual breakdown on the condensers. They are mounted in a small safety carrier which forms a lid to the whole unit.

On test the condensers showed no sign of leakage at all with a test voltage of 500. In actual use the suppressor was found to be quite satisfactory when connected at the source of the disturbance, this of course being essential.

The suppressor is supplied with very explicit instructions and can be recommended for use where the interference is known to come in on the mains supply leads.

This Belling-Lee disturbance suppressor will be found useful by those using mains receivers

TESTS OF NEW APPARATUS —Continued from preceding page

This handy AvoMinor moving-coil measuring instrument will be found very helpful for carrying out a large number of set tests

AVOMINOR

APPARATUS : AvoMinor.
PRICE : 40s.
MAKERS : Automatic Coil Winder Co., Ltd., Winding House, Douglas Street, S.W.1.

THE AvoMinor is a small multi-range instrument recently introduced by the makers of the well-known Avometer. It has seven ranges if the facility of resistance measurement is included, namely 0-6, 30 and 120 milliamps and 0-6, 120 and 300 volts. The resistance range normally includes measurements up to 10,000 ohms, but other ranges may be obtained as shown in the instructions if the voltage of the battery is increased. Normally a small 1½-volt battery is used and is held in a recess at the back of the meter and covered with a small sliding door which allows ready access. The scale of the meter is about 2¼ in. long and is marked in black on a white background. A red-tipped pointer is employed which enables the reading to be easily seen.

On test the meter was found to be excellent, being practically dead accurate on all the milliampere ranges and also on the 6-volt range. On the 120- and 300-volt ranges, however, there was a very slight error, the meter tending to read low in the first case and high in the other, the actual error being something like 2 per cent. Indications on the resistance range were dead accurate when the pointer had been set to zero by means of the small voltage-adjusting knob located in the middle of the front panel.

On the voltmeter scale the total resistance is 100,000 ohms. Thus on full-scale deflection the current is only 3 milliamperes. The meter is supplied complete with test prods and connecting leads and is a good proposition.

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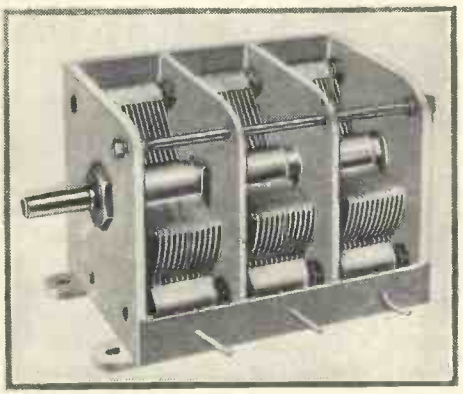
UTILITY "MITE" GANG CONDENSER

APPARATUS : Utility "Mite" gang condenser.
PRICE : 19s. without dial.
MAKERS : Wilkins & Wright, Ltd., Holyhead Road, Birmingham.

ONE of the neatest and certainly the most compact variable condensers we have tested recently is the "Mite" three-gang. This



The new Utility "Mite" ganged condenser is particularly compact and neat

condenser is primarily intended for chassis mounting and the three sections are built into a metal case which is only 3¾ in. long by 2¾ in. in height and breadth. The plate assemblies are die-cast into position, a construction which keeps them very rigid and enables very close spacing to be adopted. The moving vanes are semi-circular but the fixed plates are cut away to give an approximately logarithmic law. For superhet work the condenser can be obtained with one section having specially shaped plates. Each section is provided with a mica-dielectric trimmer and an individual earthing tag.

A slow-motion friction drive is available for the condenser, but as it is somewhat larger than the condenser itself it must be mounted either to overhang the front or to project through the chassis. The ivorine scale is calibrated in degrees and wavelengths, the latter being suitable for use with 157- and 1,900-microhenry coils.

The tested maximum capacity of the condenser was 535 picofarads as against a rating of 530, while the minimum figure was some 25 picofarads. The trimmers, which are adjustable from above, had a maximum capacity of approximately 100 picofarads.

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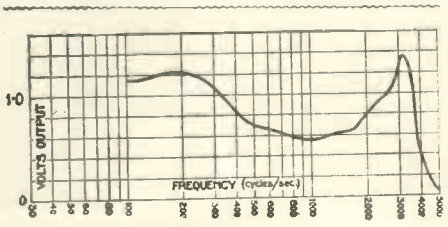
COSMOCORD UNIVERSE GRAMOPHONE PICK-UP

APPARATUS : Universe gramophone pick-up.
MAKERS : Cosmocord, Ltd.

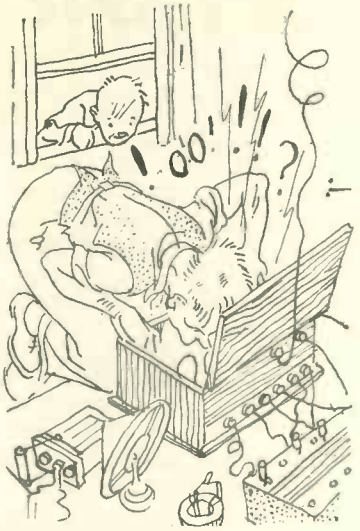
A NEWCOMER to the range of gramophone pick-ups is the Cosmocord Universe. The casing, arm and base of this pick-up are made entirely of brown moulded bakelite and the whole is quite neat in appearance. The head of the pick-up is arranged to swivel to facilitate needle changing and it also sets at an angle to enable good tracking to be obtained. An interesting point about this pick-up is that the actual weight of the head on the record is adjustable by means of varying the position of a lead counter-balance weight located at the pivot end of the arm. This adjustment is very simply made by means of a knurled knob which, when loosened, allows the weight to slide along. A carbon track variable resistance arranged to operate as a volume control is also located in the base. This is a good instrument.

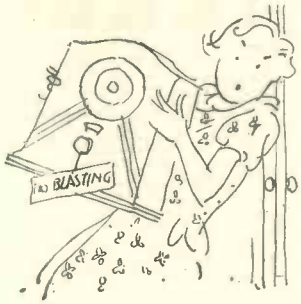


A curve showing the performance of the Cosmocord pick-up on test

The Cosmocord Universe pick-up is housed in a moulded bakelite casing

SLOGANS THAT SELL!





By IRVINE FOSTER

I'VE always felt sorry for salesmen. It must be so difficult to think out different points of appeal for all the different types of customers. Even selling a standardised article which everybody is clamouring for, such as beer or perms, must be bad enough, but radio salesmen deserve full marks in my opinion.

It isn't every man who can switch off from bandying 100 Henrys and screened pentodes with the best to selling sets to artistic housewives merely by demonstrating how well the rosewood cabinet matches the walnut what-not.

Buying is different. I rather fancy myself as a buyer, though I admit that I haven't had as much experience as I should have liked. My pleasantest day dreams have always been associated with Bond Street and a bottomless purse. But all that has been changed since we decided that we couldn't endure the brutish noises of the old set any longer. I now realise that buying a wireless receiver isn't as simple as I thought.

Slogans were the snag. At first sight the advertisements all looked so attractive that we couldn't reject any of them. Beautiful pictures of handsome sets and such a nice, friendly atmosphere. All the manufacturers seemed to take a great personal interest in us. We hated to think of the disappointment that all except one were doomed to suffer. The difficulty was to select that one.

I don't know much about electricity, although I still remember some cunning experiment with iron filings at school. I'd heard that I must have a super-het. That didn't help a lot, for they all seemed to be super-hets, though the accent was sometimes on the super and sometimes on the het. Nor did we get much further forward by reading the paragraphs headed "Specification," which trailed off into a welter of technicalities and symbols. I never was much good at algebra.

The choice was baffling. Mary who hasn't what I call the scientific mind, suggested that we should cut out all the adverts and let Albert (our youngest) pick out one at random. I agreed to try it, for the sake of peace and quiet, but it didn't work. As luck would have it, Albert drew one of those adverts in which the face of the manufacturer is designed to show, by contrast, how handsome the set is. Unfortunately Albert saw the face first and we had to interrupt the proceedings while Mary tried to comfort him.

Then I struck a slogan headed "Tuning," and read "A Child can Tune it." The man who wrote that couldn't have known our Albert. I pictured our beautiful new super-het at the mercy of his grubby hands. I imagined the precious knobs thickly coated with jam from Albert's idle twiddlings. I saw his childish delight at the rich, confused noise resulting from turning all the controls at the same time. No! The set I wanted was one that would give a child, and particularly Albert, a fairly violent electric shock if he so much as touched it.

The next set had an even worse selling point: "Every member of the family can get all the stations." Comprehensive enough, but lacking in definition. I wasn't clear whether all the family could get all the stations at the same time, in which case the need for selectivity would be transferred from the set to the family. Or whether it meant that each member of the family had his or her own pet station on at the same time, in which case the net result wouldn't be noticeably different from the pot pourri of four or five stations simultaneously which the old set produces.

Now, if it had meant that only one member of the family, namely myself, could get all the stations he wanted without interference either from other stations or, what is vastly more important, from other members of the family, that would have been the set for me. I dwelt longingly on the picture of the others muttering darkly in corners, eager for jazz from Radio-Paris or variety from Hilversum, while I tuned in, without interference, to trombone solos from Kattowice. But I couldn't believe that any set, however modern, could so change human nature.

So far the discussion had been fairly friendly, though clouds had hovered after my remarks about interference. But then Mary became very enthusiastic about an advert which boldly said "No blasting." She said that this invention was just what we wanted. It was high time that something was done about the language I used when trying to get foreign stations on the old set.

By the time the argument that followed these uncalled-for remarks subsided, we were a long way from wireless. What we are looking for now is a Harmony Super-het. We can do without knife-edges, A.V.C's and moving coils, so long as it lives up to its name. By which I mean, not so much in respect of musical quality, as its ability to promote harmony among listeners. "Only Father can tune this set" is the slogan I am waiting for.

WIRED WIRELESS FOR

MANY people object to the word "wireless" as applied to the transmission of high-frequency signals through space. They very rightly point out that from the aerial to the loud-speaker, not forgetting the tuning coils, the reception of the signal is wrapped up in a "wilderness of wires," and that the same applies to the transmitting end.

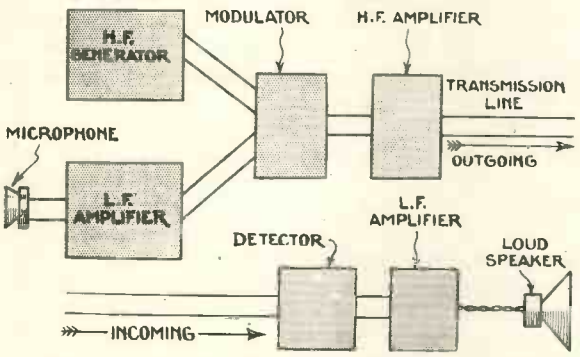


Fig. 1.—A schematic layout of a wired wireless system described in the accompanying article

The expression "wired wireless" will probably make the same folk gnash their teeth in rage, but there seems to be no really satisfactory alternative to describe the type of signalling referred to in the present article.

As we all know, the term "wireless" came to be accepted because it "touched off" the one remarkable fact that there is no connecting wire between the transmitter and receiver.

From this point of view, "wired wireless" is used to describe a method of signalling in which the same high-frequency technique is used as in ordinary broadcasting, but in which the carrier wave, instead of being radiated into space, is deliberately guided by a line or wire direct from transmitter to receiver.

It is important to note the words "high frequency." The type of relay service in which programmes are distributed from a central receiving depot to a number of local subscribers does not, strictly speaking, come under the heading of a "wired wireless," although it is often so called.

The conducting wires in a relay service merely carry low-frequency currents which have been rectified after they have already travelled in the form of ether waves from the distant broadcasting station to the local receiving depot. In other words, it is merely a final telephone network—with the local receiver at the mouthpiece.

In true "wired wireless" the signals travel all the way from transmitter to receiver along a wire in *high-frequency form.*

At this stage one may well feel inclined to ask: What on earth is the advantage of such a scheme? Why go to the trouble of discovering ways and means for sending messages across open space if you now want to abandon it and go back to the original wire connecting link?

Well, there is really a good deal more in the idea than may strike the eye at once. In the first place, it is necessary again to lay stress on the words "high frequency."

The development of ordinary broadcasting has taught us practically all we know about high-frequency working. Before the time of Marconi and his fellow-pioneers, frequencies of the order of 20,000 cycles a second were practically unknown outside the laboratory. Nowadays we talk glibly of 5-metre waves, which correspond to a frequency of 60 million cycles a second! And, what is more, we can produce and handle such frequencies without any great difficulty.

Now, high-frequency currents of this order have some peculiar properties, which put them in an altogether different class from the low-frequency currents formerly used in line-wire telegraphy and telephony. So that if and when we return to the idea of "carrier wave" signalling over wire transmission lines we do so armed with new and valuable knowledge.

For instance, we can superimpose a high-frequency or "carrier" signal on a pair of telephone lines which are already being used for ordinary telephonic conversation and, by adding a rectifier or detector for the carrier signal, we can carry on two independent conversations simultaneously, without one interfering in the least with the other.

This is putting the case at its simplest. As a matter of fact, by using several different carrier frequencies it is a comparatively simple matter to conduct four and even more separate and distinct two-way conversations, simultaneously, and without mutual overlap.

Imagine the saving in copper wire, as compared with the older methods of keeping each conversation in a separate channel — particularly in the case of long-distance trunk working where the cost of each new line runs into many thousands of pounds.

But the advantages of wired-wireless are by no means confined to

A RADIO RELAY

At the controls of the Sheffield relay station, which puts broadcast programmes over a landline. No high-frequency carrier is used

BROADCASTING

By L.S. Kaysie

ordinary telephone practice. The new technique is bound, in the course of time, to play its part—and perhaps a big one at that—in the future development both of broadcasting and television.

Mention has already been made of the local relay services which, in certain towns, already distribute the "rectified" B.B.C. programmes over wires direct to each subscriber's house. There are some advantages to be claimed for this method, but at present the choice of programme is limited. The subscriber is compelled more or less, to take what he gets.

By multiplexing carrier-currents, a true "wired wireless" broadcast service can be provided in which the high-frequency currents travel from beginning to end over guiding wires. Such a service can supply a number of different programmes simultaneously, and give each subscriber the power of selecting at will the particular item he desires.

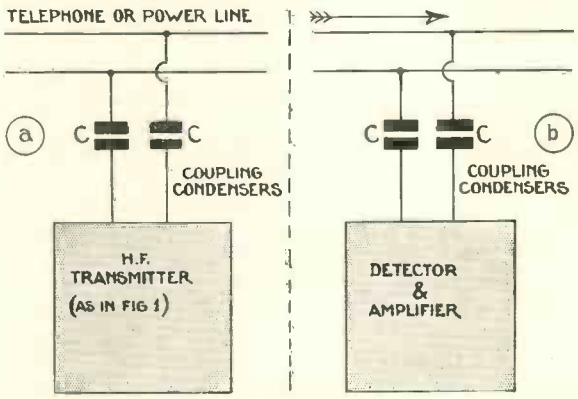


Fig. 2.—(A) indicates the way in which carrier-wave signals are superimposed on a telephone line without interfering with the ordinary low-frequency conversation. (B) shows how the receiver is connected

It is important to note that the selection is made with relatively simple apparatus, for instance by using fixed "filters." When one of these is switched into circuit, it serves to pass the particular programme required, and to reject all others.

Let us consider for a moment what actually occurs at the transmitting aerial of an ordinary broadcast station. The signal energy is radiated into space in all directions—anything from 5 to 100 kilowatts of it. How much of this actually "gets home" on to one or other of the myriads of receiving aerials scattered up and down the country, and how much is simply wasted in thin air?

The percentage of signal energy intercepted and used, to that actually radiated, must be very small indeed.

On the other hand, contrast the wired-wireless proposition, where every milliwatt of energy is fed into a line-wire which guides it direct to each subscriber. If his set is not switched on, then there is no consumption and no waste. In fact, nothing is wasted except some unavoidable ohmic loss in the wire.

In telephone practice we know that a very few watts of input energy are sufficient to convey intelligible speech over a hundred miles of wire, simply and solely because it is "directed" by the cable and not distributed recklessly in all directions.

On this basis, a mere fraction of the power now radiated by the London or National transmitter would—if it were fed directly into distributing wires—be sufficient to give loud-speaker reproduction to a million subscribers over a radius, say, of a hundred miles.

In addition, no subscriber would require to fit more than two valves at most to get ample loud-speaker volume. In most cases it would be sufficient to use one valve coupled to a simple crystal detector.

The same economy would govern the case of "multiple" programmes. Because it comes directly by a wired path, the level of input energy is thousands of times higher than the pick-up on an ordinary aerial. The consequence is that no high-frequency amplifier stages are necessary—and no complicated "selectivity" circuits to separate one programme from another.

This, of course, is assuming a wire distributing network to be available, and to be properly "loaded" to carry high-frequency currents.

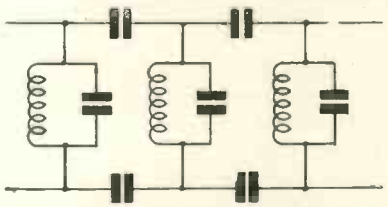


Fig. 3.—A typical form of "fixed" filter circuit, used to separate the different carrier frequencies when a number of wired wireless programmes are being simultaneously transmitted

Naturally, this is a big "if." But, in point of fact, the existing telephone service represents one possible network which could be made available with a minimum of expense. The electric supply mains offer another possible channel for the same purpose—though here the expense of adapting the wires to carry high-frequency circuits without attenuation would be more considerable.

Fig. 1 shows the schematic layout of a wired-wireless system, whilst Fig. 2a indicates the way in which carrier-wave signals (from the transmitter in Fig. 1) are superimposed on a telephone line, without interfering with ordinary low-frequency conversation.

The coupling condensers C prevent any low-frequency currents in the line from passing into the high-frequency transmitter, though they readily pass high-frequency currents from the transmitter into the line. In the case of electric supply mains, the coupling condensers also protect the high-frequency apparatus from the high voltages in the line.

Fig. 2b shows how the receiver is similarly connected at the distant end of the line.

Fig. 3 shows a typical form of "fixed" filter circuit, used to separate the different carrier frequencies when several high-frequency programmes are being sent simultaneously over the same lines in order to give the subscriber a choice of selection.

REGGIE HOLMES opened a wary eye. It hurt. He closed it again, and groaned feebly.

Slip-slap went the waves against the side of the boat—slip-slap went his luggage as it slid along the floor of the cabin. Slip-slap went everything. He shuddered and shrank under the blanket as the ship slid sullenly down one wave and crashed into the next.

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Two hours later on the train to Victoria he tried to collect himself and rearrange the scattered impressions of what had occurred.

Exactly ten days ago, his pal, Bob Travers, had persuaded him to try a walking tour in the Ardennes. Not that he could afford it, but Bob had obviously struck a lucky patch, and like the good sport he was, insisted upon Reggie taking a loan.

The weather was simply perfect in the Ardenne hills, bright and dry, but not too hot for walking. For a whole week they had been early afoot, and had broken the back of the day's mileage before taking the lunch parcels out of their packs. A couple of hours' luxurious rest and a smoke, and then off again towards the distant village marked out for the evening meal and a well-earned bed.

They had deliberately avoided large towns and had not seen an English paper for days. It was quite a relief to lose touch with events at home, until Bob, who was rather keen on tennis began to feel he'd like to know how the championships were going at Wimbledon.

After dinner, that very evening, they heard the unmistakable sounds of " T.S.F." coming from the room reserved for the use of Madame the proprietress of the little hotel.

It did not take long to pick up the long-wave National, and they settled down to listen to the news.

Almost at once came tragedy—swift and unexpected.

" *Before giving to-night's news, I have the following S.O.S. message. Will Reginald Holmes, at present believed to be on a walking tour in the country, please come at once to eighty-nine Braxton Square, London, where his aunt, Isabel Dean is lying seriously ill.*"

◆ ◆ ◆

" Why didn't we have another drink instead of monkeying about with wireless—or why didn't we go to bed early—or why didn't the blessed set refuse to function," groaned Reggie to himself, recalling his painful pilgrimage home.

To begin with, the first available train had started—five miles away from the hotel—at seven o'clock the next morning. Then it had taken hours to get to Ostend—a cross-country journey with interminable stops and changes.

Meanwhile the weather had also turned sour, and the final four hours on a choppy sea were, Reggie thought bitterly, " the purple limit."

His Aunt's keen grey eyes, and rather lonely old face came vividly before him as he heard the S.O.S.

" I wouldn't go, only I know I'm the only one she cares a damn for," he had said to Bob.

◆ ◆ ◆

So here he was, nearing the end of the journey.

Twenty minutes before the train was due at Victoria, he swallowed a few gulps of whisky from his flask, in preparation for the rush at the other end. On an empty stomach this had such a tonic effect that Reggie leapt out of the train, tore through the barrier, and threw himself into the nearest taxi, leaving his rucksack on the luggage rack !

A white-robed nurse answered the door at number eighty-nine Braxton Square.

" Am I in time ? " he gasped.

The nurse smiled reassuringly.

" Oh yes, sir," she said. " Miss Dean is quite comfortable now—the attack is over."

The old lady, sitting up in bed, smiled brightly at him.

" Well, Reginald—I just managed to pull through this time. My time is not up yet, evidently. I hope you had a pleasant journey up from the country. Reginald (sharply) you've been drinking. I smell whisky."

" Dear Aunt Isabel," said Reginald weakly, " forgive me, but I *must* go now and get thoroughly tight—to celebrate your recovery. I'll explain everything later."

◆ ◆ ◆

Whether the Recording Angel played a hand or not, it is a fact that soon after the dramatic interruption of his holiday abroad, young Holmes managed to secure a well-paid post in the Provinces—and eighteen months later consolidated his new dignity by getting married.

Aunt Isabel—still very much in the flesh—excused herself from travelling north to attend the wedding, but hinted that she would not forget the happy couple.

On the return from the honeymoon, a massive packing-case was found waiting in the hall. Before tackling it Reggie tore open a covering letter in his Aunt's handwriting.

Inside was the following brief note: " *As a wedding present I am sending you my own wireless set (three valves and reflexed crystal), complete with batteries and horn loud-speaker—as a souvenir of your loyal affection and in remembrance of a certain journey.*"

S. J. H.

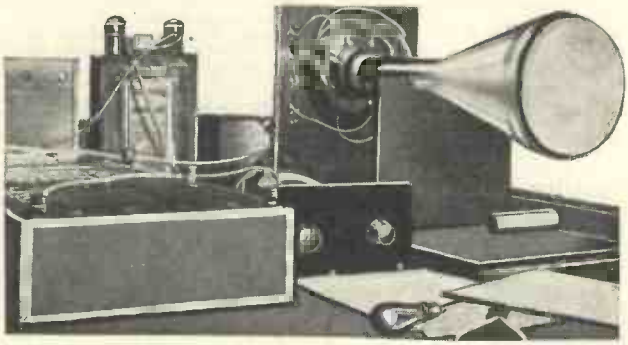
HOME TELEVISION SECTION

A Cathode-ray Television Receiver

By J. H. REYNER, B.Sc., A.M.I.E.E.

This receiver is the result of some months of experiment during which the best methods of carrying out the various processes have been found. In particular, stability of operation has been aimed at so that results can be obtained with certainty and the picture held with a minimum of adjustment

IT was explained last month how to set up a cathode-ray tube for ordinary purposes. This article will deal with the particular application of the tube to the reception of television pictures. For this purpose we make use of *time bases*, which are circuits which cause the spot of light to move across the screen regularly and at a more or less steady frequency.



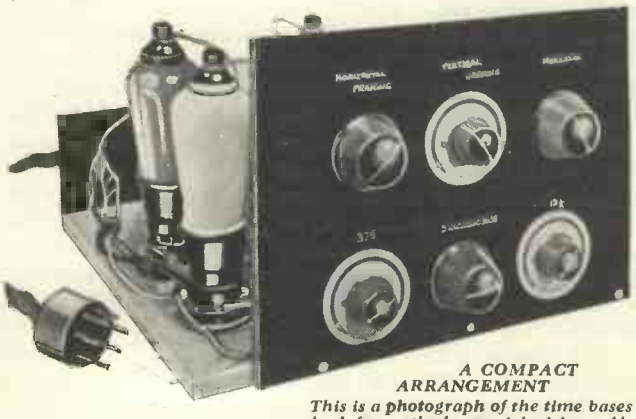
READY FOR TELEVISION
Here is the entire equipment needed for receiving pictures

Consider the requirements for a moment. In a mirror drum or disc receiver, the spot of light is caused to move from the bottom right-hand corner of the screen up to the top right-hand corner. Just as it reaches this point another spot of light appears at the bottom and proceeds to trace out a second line of light next to the original line, and so the process goes on until 30 such lines have been built up on the screen, when the whole process starts again. The complete picture is built up in a twelfth-and-a-half part of a second.

In a cathode-ray tube we produce the same effect in the following manner. The spot of light is caused to move steadily upwards from the bottom right-hand corner to the top. Having reached the top it flies back to the bottom very rapidly and starts the process again. This can easily be done by applying a suitable voltage to the vertical or Y deflector plates. At the same time we apply another voltage to the X or horizontal plates which causes the spot of light to move from right to left at a slower rate. The effect of this is that when the spot flies back and starts to move upwards again it does so slightly to the left of where it started before, so that we build up a line parallel to the first one. At the end of this line the spot flies back and starts on the third line, which again is shifted a little to the left, and so we go on until 30 lines have been built up, when the process starts all over again at the bottom right-hand corner.

This process is carried out with absolute regularity, and if the various lines traced out at each successive occasion lie exactly on top of the path traced out on the preceding occasion, we shall get the impression of a stationary image consisting of the requisite number of lines. This builds up a picture for us in exactly the same way as a mirror drum or disc would do, and by modulating the intensity of the light at suitable points we can produce a picture.

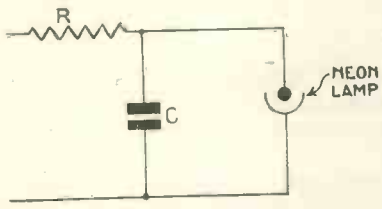
The point to be decided now is just how to produce the voltage on the deflecting plates which will cause the spot to move in the manner just described. For this purpose we use a condenser which is charged from a battery (or other source of voltage) through a high resistance. Due to the presence of the high resistance in the circuit the condenser does not charge up immediately but takes an appreciable time to do so. In fact, if we make the resistance very large it may be several seconds before the condenser charges up properly. During this charging period the voltage on the condenser is slowly rising (reaching its maximum value equal to the applied voltage when the condenser is fully charged). This gives us exactly what we want for if we connect the deflector plates across the condenser we shall obtain a gradually increasing



A COMPACT ARRANGEMENT
This is a photograph of the time bases required for cathode-ray television. Although there are a number of controls they are quite simple to operate

voltage which will move the spot slowly across the screen. If we apply the voltage to the X plates the spot will move horizontally; if to the Y plates, vertically.

This gives us the slow travel up the screen which is what we want. When we have built a line of sufficient length on the screen,



THE NEON FLASHER
Fig. 1. A simple type of time base using a neon lamp

however, we have to stop the process, making the spot fly back to the starting point and recommence. This is done by discharging the condenser. We might do this mechanically by having some sort of rotating commutator, but it is more usual to obtain the results electrically. The neon lamp is a device which can be used for the purpose (see Fig. 1). The ordinary neon lamp will not glow until the voltage across it reaches a certain amount. Once this critical voltage is reached, current flows through the lamp in a form of a discharge which gives the characteristic pink glow. If we connected a neon lamp across the condenser in a charging circuit we have just considered, as soon as the voltage on the condenser reached the critical value the neon lamp would start to conduct and would discharge the condenser.

The Gas-discharge Triode

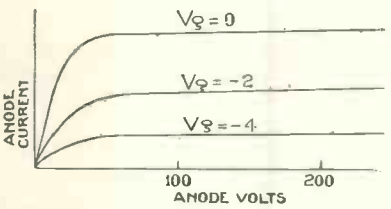
There are two objections to this simple arrangement. Firstly, the neon lamp would not discharge the condenser completely. When the voltage had fallen by some 30 volts or so the lamp would go out. The charging process would recommence and the lamp would continue to flick in and out more or less regularly. This form of circuit has been used, but it will clearly only give a total change in voltage on the deflector plates of the difference between the "firing" and the "extinction" voltages of the neon lamp. This is usually about 30, although lamps have been made with greater ranges than this.

Better results are obtained by using a gas-discharge triode. This is an ordinary valve having a filament or cathode, a grid and an anode, but instead of having a high vacuum inside the bulb there is a small amount of gas—either neon or mercury vapour or other suitable gas. If we increase the negative bias on a valve the anode current is reduced and a point is ultimately reached where no current will flow at all. This point depends on the anode voltage, and the larger we make the anode voltage the more the negative bias required to produce a cut-off of the current.

Conversely, if we apply a given negative voltage to the valve and gradually increase the anode voltage no current will flow until the anode voltage reaches a certain critical value. This is the way these tubes are used. They are connected across the condenser and a small voltage is placed on the grid. The tube is non-conducting until the voltage on the anode reaches the critical value determined by the setting of the grid voltage. At this point current commences to flow and the condenser proceeds to discharge.

REMARKABLY COMPACT
A rear view of the time bases: Note the X and Y shift controls on the sub-panel in the foreground

This is where the gas filling comes in. As soon as any current flows the gas gets ionised and instead of a normal anode current a glow discharge takes place. In other words, the condenser discharges very rapidly indeed—far more rapidly than it would do if we relied simply on the anode current of the valve. What is more, once this discharge has started it will continue to flow as long as there is any voltage on the anode, irrespective of the grid voltage. This means that the condenser continues to discharge right down to zero voltage, so that if we set the discharge tube to fire at, say, 250 volts, then the voltage on the condenser will build up to this value and then discharge to nothing again, giving us a large available voltage on the deflector plates.



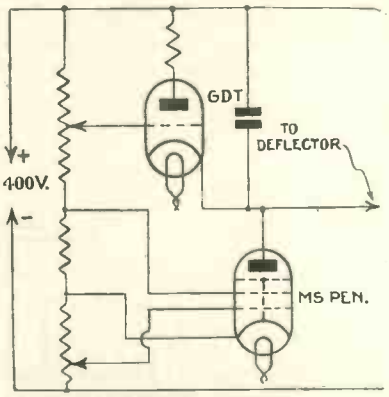
USING A PENTODE
Fig. 2. Curve showing how with a given setting of grid voltage the current is practically constant irrespective of anode voltage

If a condenser is charged through a resistance the current is not constant. At the beginning the charging current is large, but as the condenser gets charged the current gradually gets smaller and smaller. Consequently the rise in voltage on the condenser is not uniform, so that the movement of the spot across the screen is not absolutely steady and this would introduce distortion in our picture.

This is overcome by using some form of constant-current device instead of a resistance. One way is to use a saturated diode which is a simple two-electrode valve having filament and anode but with the filament under-run so that the maximum current which it will give is limited irrespective of the high-tension on the anode. This will do what we want, for when the condenser commences to charge and there is a large voltage across it the saturated diode is unable to supply more than a small amount of current and this current remains constant all the time the condenser is charging up.

An alternative method and one which is used here is to employ a screen-grid or pentode valve. The

characteristics of a pentode are shown in Fig. 2, and it will be seen that for a given setting of grid voltage the current is practically constant. This gives us exactly the same effect, and it has the advantage that the constancy holds down



THE BASIC CIRCUIT
Fig. 3.—Here are the fundamentals used in the receiver

to about 30 volts on the anode, making it possible to obtain large voltage changes with practically constant current.

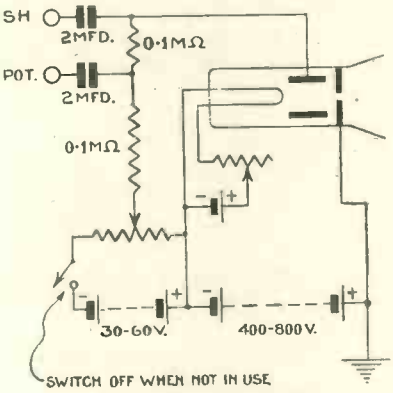
The actual value of the current is controlled by varying the voltage on the grid, and Fig. 3 shows the basic circuit which is used in the present receiver. There is a source of supply delivering 400 volts. Across this is a potentiometer, and also across it are the condenser and the screened pentode in series. Across the condenser is connected a gas-discharge tube which is arranged to trigger at the required point by varying the position of the slider on the grid potentiometer. Actually for convenience this slider controls the voltage on the grid relative to the anode, but it comes to the same thing as putting negative bias on the grid relative to the cathode. These tubes have a control ratio (or amplification factor) of about 25, so that with 10 volts negative on the grid the tube requires 250 volts on the anode before it will start to discharge.

The actual charging rate of the condenser is determined by varying the voltage on the grid of the pentode charging valve in conjunction with the actual size of condenser. For a frequency of 12½ per second the condenser is about 1 microfarad, while for the 375 frequency required for the vertical scanning a value of .02 is sufficient. The voltage to which the condenser will charge (which determines the length of the line on the screen) is controlled by the voltage applied to the grid of the gas-discharge tube. The condenser charges up until the critical voltage is reached. The gas-discharge tube then fires, discharging the condenser and starting the process again. This continues regularly at a frequency which can be varied at will by altering the voltage on the grid of the charging valve, and that is all there is to it. In order to prevent dangerously high currents flowing through the gas-discharge tube a small limiting resistance is placed in the anode circuit as shown. This should not be more than a few hundred ohms or it will slow down the discharge in the condenser and this is undesirable.

Two such bases are required for a television receiver. One of these has to produce 375 discharges per second. This will produce 30 discharges in a twelfth-and-a-half of a second, giving us the 30 lines. This voltage is applied to the vertical or Y deflector plates. On the X plates we apply a voltage varying 12½ times a second. This moves the spot horizontally across the screen so that the vertical lines are all placed side by side. When 30 such lines have been obtained (in a twelfth-and-a-half of a second) the spot flies back and starts again, so that we build up the picture in a horizontal direction 12½ times a second.

"Locking"

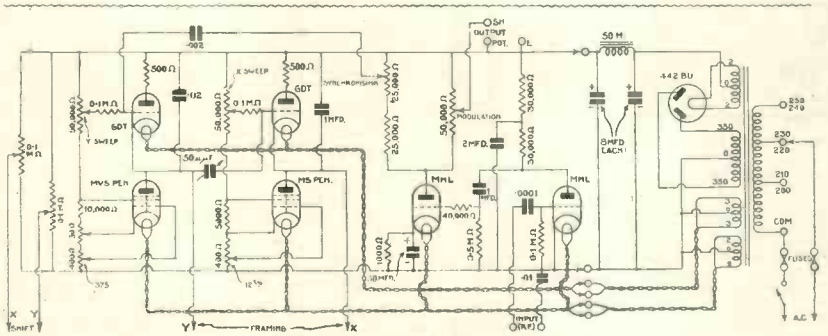
It is necessary to lock the two bases together in order to ensure that there shall be exactly 30 lines



THE TUBE CONNECTIONS
Fig. 4.—This diagram shows how the tube is modulated by varying the voltage on the shield

in the picture. If the frequency of the horizontal base is not exactly 12½, then the successive pictures will not lie exactly one on top of the other and a blurred effect will result. This locking is obtained by feeding back a small part of the voltage from the 375 tube on to the grid of the 12½ tube. The manner in which this works I shall have to explain in a future article, but it has the effect of ensuring that the 12½-cycle gas-discharge tube can only trigger at the correct instant, so that we must have an integral number of lines on the picture. It is possible to obtain 29 or 31, or for that matter any number, but provided this locking connection is included there will always be an exact number of lines.

A somewhat similar process is used to synchronise the whole picture. On the Baird transmission a special synchronising impulse is sent out 375 times a second. A small portion of the voltage from the receiver is therefore fed on to the grid of the 375

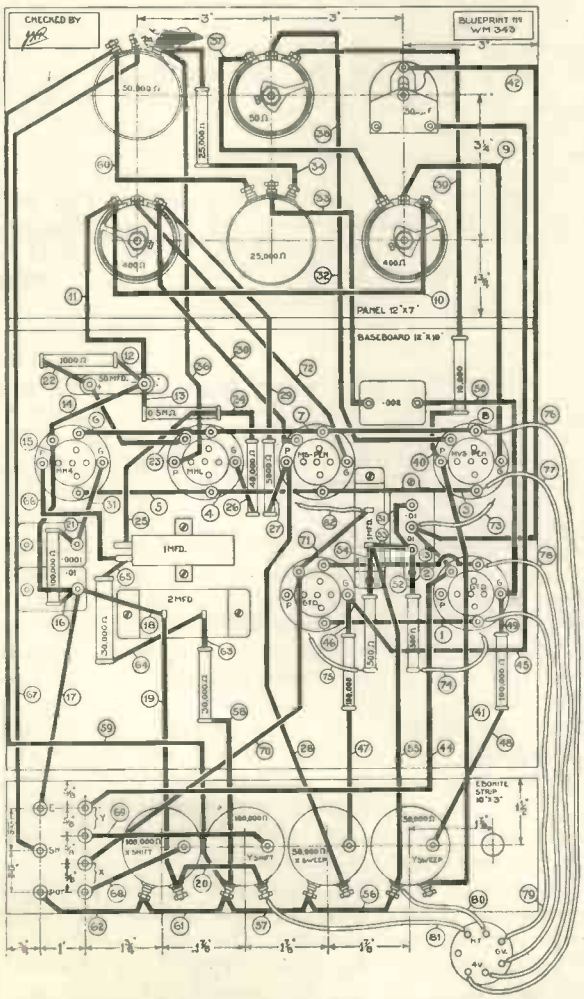


THE COMPLETE CIRCUIT
This is the circuit of the receiver shown by the photographs and the layout diagram on the next page

tube and the synchronising impulses then lock the 375 tube so that it triggers at exactly the right number of times per second. Since this tube in its turn is locking the 12½ tube the whole picture is synchronised.

The receiver itself is a simple detector and low-frequency outfit, resistance-coupled and using values which give a very good low- and high-frequency response. No tuning circuit has been included because that depends upon the situation of the user. Where I am at Elstree I use a simple bandpass filter. A user situated farther away could use a single tuned circuit, whereas a reader still farther away might have to include a high-frequency valve. No reaction is used on the circuit at all to avoid any high-note loss. By building the receiver in this way I felt that it would meet the requirements of most readers who could quite easily add the additional tuning circuit for themselves.

I shall have to give more details as to the whys and wherefores next month. I have space for only a brief description of the actual use of the receiver. The various battery voltages are all obtained from the eliminator by plugging in the seven-pin plug. The X and Y plates of the cathode-ray tube are connected to the X and Y terminals at the back. The terminals marked SH and POT are connected to the shield as shown in Fig. 4. They may actually be taken to an output transformer if desired, but I prefer the condenser-resistance coupling since this gives better contrast. The condensers must have a working voltage equal to the sum of the gun voltage + 400 volts. Actually I used two 2-microfarad T.C.C. 1,500 volt working condensers, but if the gun voltage is only 400 volts then 800-volt working condensers will be satisfactory.



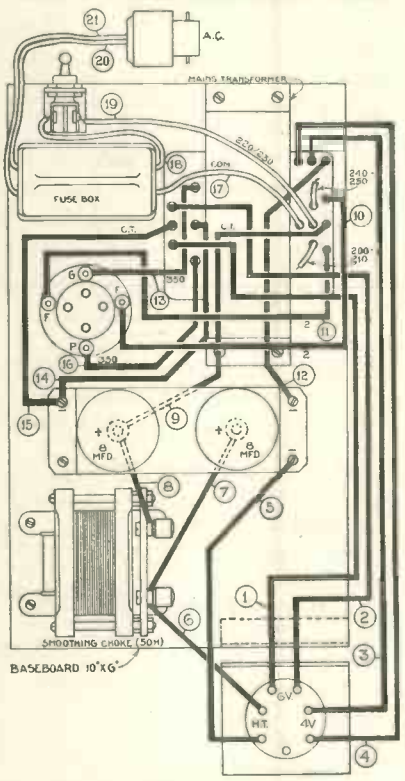
THE LAYOUT AND WIRING DIAGRAM

A full-size blueprint will facilitate construction and this can be supplied at half price (9d.) post free if the coupon on the last page of this issue is used before December 31

At the back will be found the X and Y shifts. These are potentiometers across the supply, and they move the whole picture laterally or vertically across the screen. The X and Y *sweep* potentiometers control the voltage at which the gas-discharge tubes trigger. By this means the length and breadth of the picture are controlled.

Operation

In operation the cathode-ray tube is switched on and the spot focused sharply. The size of the picture is adjusted by the X and Y sweep potentiometers until it is of the right proportion (7 vertical to 3 horizontal). Frequencies are then adjusted by the 375 and 12½ potentiometers on the front until they are approximately correct, when 30 lines will be obtained on the screen. The 12½ frequency may be estimated by taking off the bottom X plate connection and holding it in the hand, allowing the fingers to touch the wire. There will be enough capacity pick-up to show a slightly wavy line on the screen and the frequency of the 12½ potentiometer should be adjusted to exactly four waves.

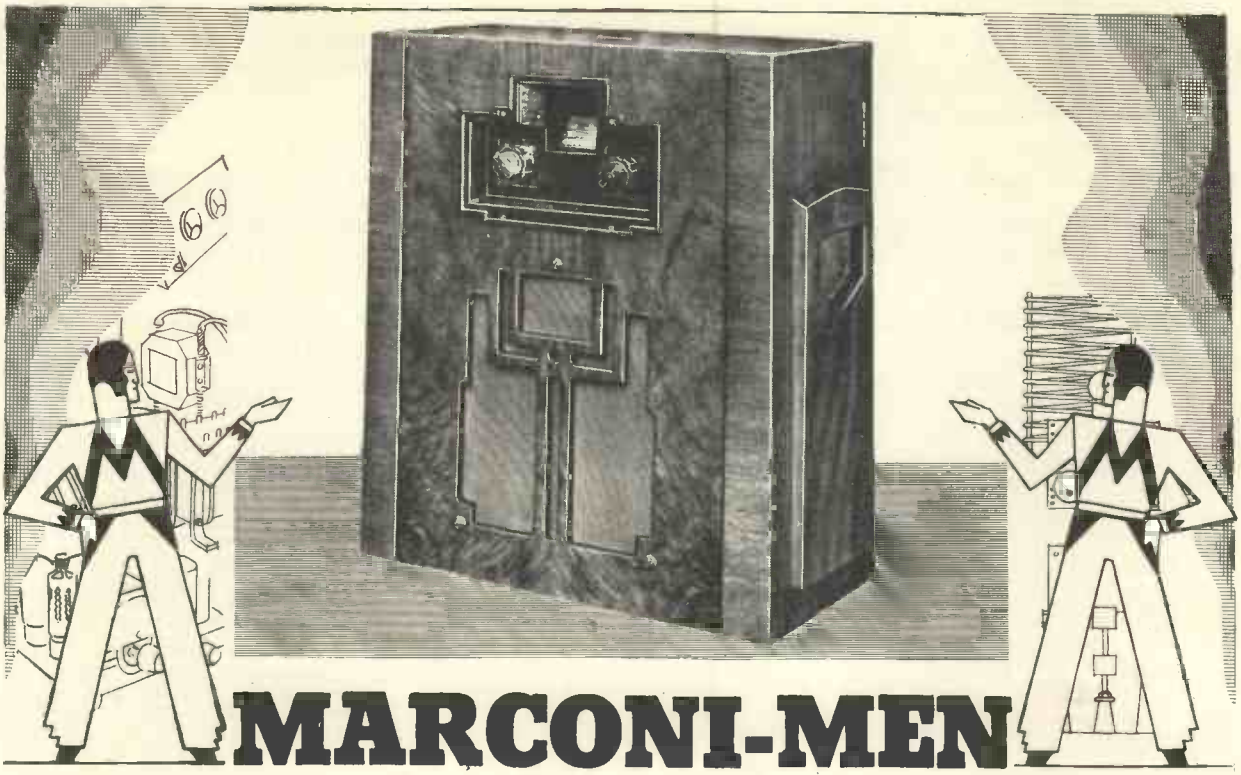


THE POWER SUPPLY

The layout and wiring diagram of the mains unit. A full-size blueprint of this is also available at half price (6d.) if the coupon on the last page is used before December 31

Having obtained 30 lines all the work is done on the top three controls. The centre one gives a fine adjustment of the 375 frequency which gives a vertical framing. As this is rotated one way or the other the picture will move upwards or downwards out of the frame. Horizontal framing is obtained by alteration

Continued on page 550



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A CATHODE-RAY TELEVISION RECEIVER

Continued from page 548

of the locking condenser on the extreme left. Adjustments should be carried out with the synchronising control (bottom centre) at minimum until the frequency is practically correct. A small increase on the synchronising control will then lock the picture and it will remain steady.

The picture modulation is controlled by the knob on the top right hand, in conjunction with the shield bias control on the cathode-ray tube. Increase the shield voltage so that the focus is softened and the lines blend together to give a continuous and not very bright rectangular patch. The application of the signal (by adjustment of the modulation control) will then cause the picture to appear. I shall have more to say about this next month.

COMPONENTS NEEDED FOR TELEVISION TIME BASES AND MAINS UNIT

BASEBOARD
1—Peto Scott, 12 in. by 10 in.

CONDENSERS, FIXED
1—T.C.C. .0001-microfarad, type S.
1—T.C.C: .002-microfarad, type S.
1—Peak .01+.01 (used as .02).
1—T.C.C. .01-microfarad, type S.
2—T.C.C. 1-microfarad.
1—T.C.C. 2-microfarad.
1—T.C.C. 50-microfarad electrolytic.

CONDENSERS, VARIABLE
1—Bulgin 50-micromicrofarad panel-mounting neutralising.

HOLDERS, VALVE
6—Telsen 5-pin.

PANEL, ETC.
1—Peto-Scott, 12 in. by 7 in., ebonite.
1—Peto-Scott 10 in. by 3 in., terminal strip.

RESISTANCES, FIXED
2—Erie, 500-ohm.
1—Erie, 1,000-ohm.
1—Erie, 5,000-ohm.
1—Erie, 10,000-ohm.
1—Erie, 25,000-ohm.
2—Erie, 30,000-ohm.
1—Erie, 40,000-ohm.
3—Erie, 100,000-ohm.
1—Erie, ½-megohm.

POTENTIOMETERS
1—Igranic, 50-ohm.
2—Igranic, 400-ohm.
1—Igranic, 25,000-ohm.
1—Igranic, 50,000-ohm.
2—Lewcos, 50,000-ohm.
2—Lewcos, 100,000-ohm.

SUNDRIES
Connecting wire and sleeving (Lewcos).
4 yards thin flex (Lewcos).
1—seven-pin plug.

TERMINALS, SOCKETS, ETC.
3—Belling-Lee, type R.
4—Belling-Lee insulated plugs and sockets.

VALVES
2—Cossor, 41MHL.
1—Cossor MSPen.
1—Cossor MVSPen.
2—Cossor gas discharge triodes, 6-volt 1½-ampere.

MAINS UNIT

BASEBOARD
1—Peto Scott, 10 in. by 6 in.

CHOKES, LOW-FREQUENCY
1—Rich & Bundy 30-henry 30-milliampere.

CONDENSERS, FIXED
2—Dubilier 8-microfarad electrolytic.

HOLDER, FUSE
1—Belling-Lee twin complete with 1-ampere fuses.

HOLDERS, VALVE
1—Telsen four-pin.
1—Telsen seven-pin.

SUNDRIES
1—British Radiogram metal mounting bracket, 2¼ in. by 2 in.
1—British Radiogram 2 in. metal mounting bracket.
1—British Radiogram metal mounting bracket for electrolytic condensers.
1—Goltone standard mains plug.
Connecting wire and sleeving (Lewcos).

SWITCH
1—Bulgin single-pole toggle on-off.

TRANSFORMER, MAINS
1—R.I., with the following windings:—
350-0-350 volts, 30 milliamps.
3-0-3 ,, 3 amperes.
2-0-2 ,, 4 ,,
2-0-2 ,, 2 ,,

VALVE
1—Cossor 442BU.

TELEVISION RECEPTION WITH THE MIRROR-DRUM RECEIVER

Some practical notes on reception with a mirror drum—

By H. CORBISHLEY

LAST month a description was given of a mirror-drum television "hook-up," a simple apparatus which comprised all the requirements for mirror-drum television reception. In this article it is proposed to explain how this can be used and what auxiliary apparatus will be required. It is intended only to consider the vision receiver and amplifier, because it is assumed that everyone who takes up television will already be in possession of a receiver suitable for picking up the sound side of the transmissions, which, of course, are on a separate wavelength.

For the vision signals we can employ a combined receiver and amplifier or we can have two separate units. This latter way is probably the better, for then the amplifier can be used separately, and being powerful and distortionless will be ideal for record reproduction or public-address work.

The choice of a suitable receiver will depend to a very great extent upon the situation and distance from the transmitter but for ordinary distances of, say, up to sixty miles or so, a high-frequency and a detector stage will answer quite well. Such distances, however, are by no means the limit for

Continued on page 552

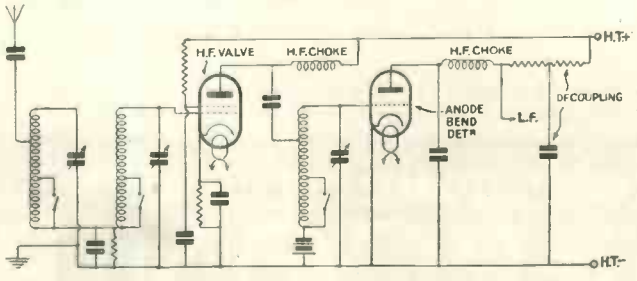


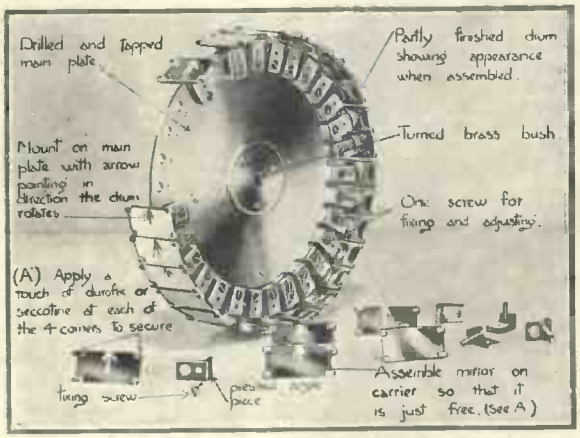
Fig.—1. A SUITABLE RECEIVING CIRCUIT
Here is a circuit employing band-pass tuning and power anode-bend rectification suitable for the reception of vision signals

TELEVISION RECEPTION WITH THE MIRROR-DRUM RECEIVER

Continued from page 550

the reception of television, for it is successfully received in Scotland.

The receiver must possess a fair degree of selectivity otherwise distortion will be produced owing to interference. A too-selective receiver, however, would tend to cut the higher frequencies, and as these enter largely into the composition of the television broadcasts this would be undesirable. Experience has shown that band-pass tuning is the most suitable, and that it is desirable to use power anode-bend rectification.



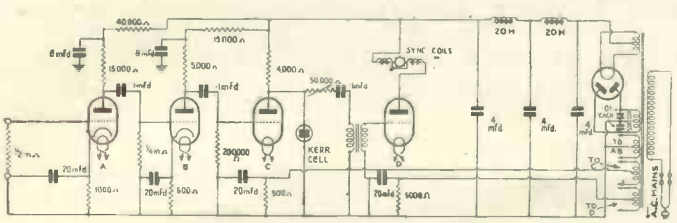
BUILDING A MIRROR DRUM

Fig. 4. This photograph shows how a mirror drum of the type used is assembled

A circuit of a suitable receiver is given by Fig. 1; it will be seen that no reaction is used, as with this there would be a certain amount of distortion introduced, which is fatal to good results in television.

The amplifier must also be distortionless, and on this account resistance-capacity coupling is practically essential in order to ensure a good frequency response. In order to obtain a bright picture the output must be considerable; this should be approximately four and a half to five watts at five hundred volts. A circuit of an amplifier specially designed for television is shown by Fig. 2. A full-size blueprint of this is available from these offices (price 1s. 6d.) which will enable this amplifier to be built without any difficulty. Examination of the circuit will show that the modulation amplifier comprises three stages and that there is an additional valve for the synchronising coils of the motor. The synchronising arrangements were not given in the experimental receiver described last month, and therefore this valve can be omitted if desired, but it is shown here because when at some future time the receiver is built up into a complete apparatus it will be required.

Briefly the synchronising gear consists of a cogged drum which is mounted on an extension of the motor spindle and revolves between the pole pieces of two coils. The apparatus is quite simple and can be added to any motor, provided that there is an extension of the spindle sufficiently long to take the cogged drum. A useful substitute for the synchronising gear is a stroboscopic disc with eight radial spokes (see Fig. 3). If this is viewed by the light of a neon lamp connected to a 50-cycle A.C. supply, the spokes will appear stationary when the speed of the motor is exactly 750 revolutions per minute, and it will be found that it can be held fairly consistently at this speed by means of a rheostat with a value of 150 ohms, or with some friction device.



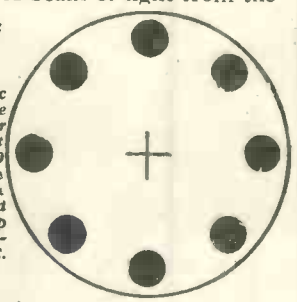
AMPLIFYING THE VISION SIGNALS

Fig. 2. The amplifier for television must be distortionless and this is ensured by the use of resistance-capacity coupling. A layout and wiring diagram of this circuit can be had from these offices, price 1/6

The operation of the receiver requires little comment for there are no mirrors which require adjustment and every necessary setting is provided for. Assuming that the mirror drum is purchased unadjusted (they are cheaper in this condition) the following notes will be useful. The assembly of the drum will be clear from the photograph, Fig. 4, and before any adjusting is carried out all the carriers should be mounted with the mirrors in place. Select any one mirror and so fix it that it is parallel with the shaft and equidistant on both sides from the drum edges.

Next prepare a rectangular paper screen about 3 in. by 7 in. Draw a line down the centre of this and another line horizontally across the centre. Fix the screen so that the vertical line is opposite the centres of the mirrors on the drum and the horizontal line parallel with the shaft of the motor.

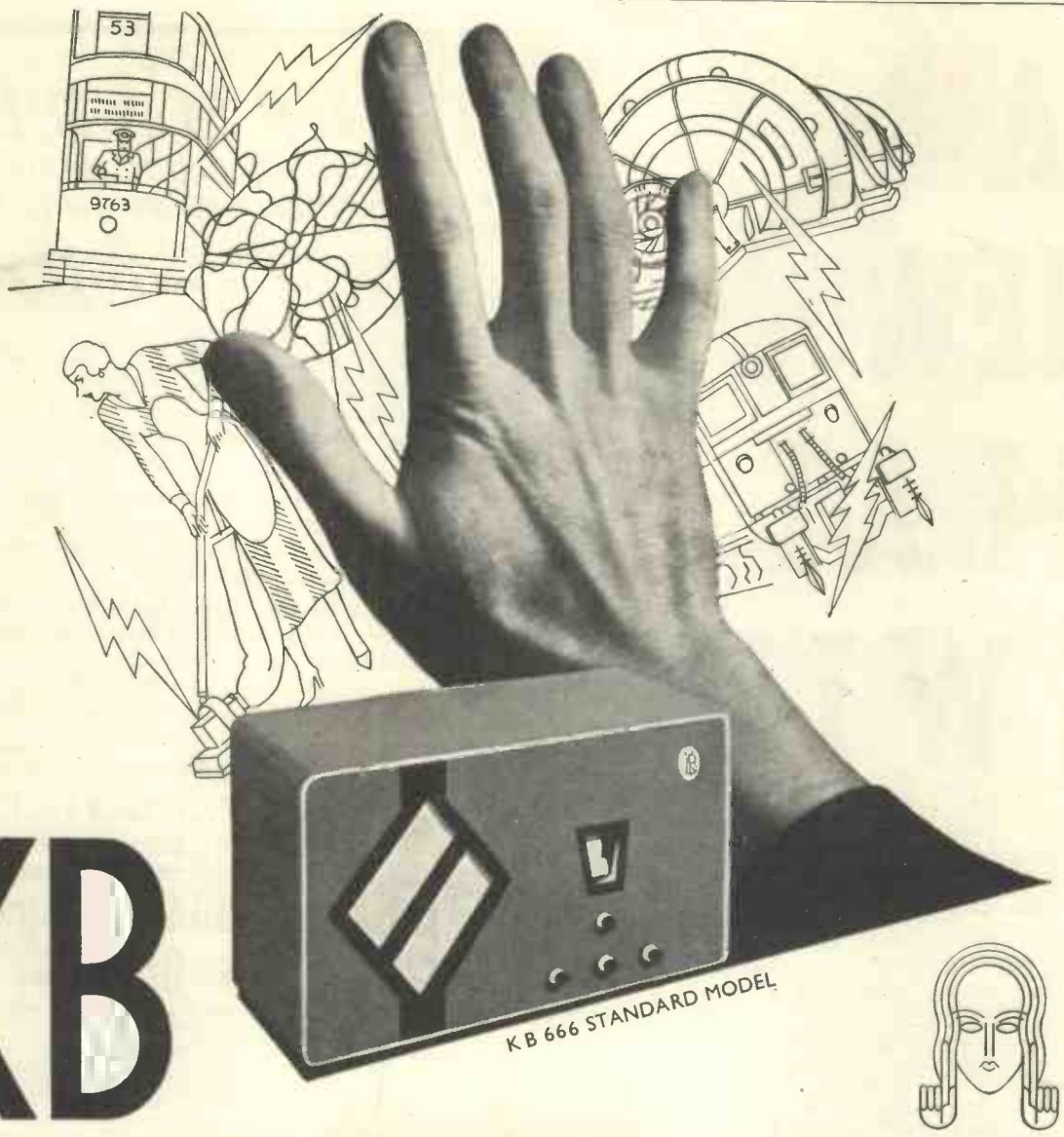
For convenience we will call the mirror which is already adjusted No. 15. A beam of light from the optical unit should now be thrown on to this (the Kerr cell having been removed and a mask with a $^1/_{10}$ in. square hole having been put in its place) and the screen should be so placed that the reflection falls on the left of the intersection of the two lines on the screen. The drum is then turned anti-clockwise and the next mirror adjusted until the light spot takes up the correct position to the left of this, its position being indicated by a pencil mark on the screen.



CHECKING THE DRUM SPEED

Fig. 3. A disc of this type will appear stationary at a speed of 750 revolutions per minute when viewed by a lamp fed from 50-cycle A.C. mains

This procedure should be continued until mirror No. 30 is reached when the drum is turned back again to No. 15 and the adjustments carried out in the reverse direction until, finally, we arrive at No. 1, when all adjustments will have been made. It is a convenience to rule the screen into spaces $^1/_{10}$ in. wide in the first place, as this will obviate marking it as each spot is formed.



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CHOOSING YOUR RECORDS

Here are reviews of the latest releases by WHITAKER-WILSON, the "W.M." Music Critic

WHAT is your taste in tenors? There is a good assortment this month. There are sweet, sugary, and sympathetic tenors; robust and roaring tenors; opulent operatic tenors; and one who lets off half a dozen top C sharps—right from his diaphragm, too. None of your soft-palate croonings about him.

I will give you his name right away—Herr Joseph Schmidt. His songs are first rate. One is in Spanish and the other in German. You will find him on a plum-label record of H.M.V. (D8033).

Do you remember the days when everybody sang *Until*? They sang it until everybody else got weary of it, but very few have sung it as Richard Crooks sings it on H.M.V. DA1337. Well worth having. The other side is *A little Love, a little Kiss* treated suitably.

◆ ◆ ◆

A sort of go-between these two tenors is John McCormack, who can always be trusted to do things decently. He is reserved and highly vocal in *Love's Roses* and *My Moonlight Madonna*, which appeals to me as being a well-written song. Probably you know it. Anyhow, it is to be had, complete with Percy Kahn at the piano, on H.M.V. DA1341.

Richard Tauber is one of those distinctive tenors who likes to do things in style. If he were to buy a tattered copy of a forgotten ballad secondhand in Charing Cross Road, he would take it to the Parlophone people and sing it as though it had come straight out of Covent Garden Opera House.

He sings four songs on two records this month. *Every day is not Sunday* is well worth hearing, but I liked *I greet you, my beautiful Sorrento.* He lets himself go in that. The disc is Parlophone RO20228.

The other Tauber record is 20230 with *Let me love you to-night* and *Night and Day*. This latter is from *The Gay Divorce*. You can also have it by the Comedy Harmonists on H.M.V. B8023. They make a totally different effect with it, of course.

If you take your singers much as you take the Aldershot Tattoo, you must insist on hearing bass-baritone Peter Dawson with orchestra and chorus sing the *Punjaub March* on H.M.V. B8015. It is a real rouser.

I once heard of a man who had a pig and named it Maud because it was always coming into the garden. Here we have good old Ben Davies at it again. Well, it is a relic of the old days and very acceptable. He does *Tom Bowling* on the other side (Col. DB1205).

One lady only this month—Anona Winn. Very characteristic in *Rendezvous*, a song in fox-trot rhythm, and *Hearts and Flowers*, which is a waltz. You have heard her by wireless so many times that you must know what to expect (Col. DB1203).

There is a piano solo to recommend to those of you who like "hot" piano music. I hope Balakirev doesn't read this, or he may go up in smoke at my suggesting his Oriental fantasy *Islamey* is what is called "hot."

I mean it quite nicely. It is so fiery in places that the term is really well deserved. There are cool spots when a very dreamy melody comes uppermost. In the "hot" sections it must be the devil to play, but Claudio Arrau is up to it (Poly. CA8165).

◆ ◆ ◆

Have you a canary in your house? Yes? Then do buy him a record with a work for violin, 'cello and piano called *The Canary*.

There is always a market for selections so long as the selectors are sufficiently selective in the selections. I expect you have one of the *Mikado*. I have reviewed several in the past. Even so, I have a word for the one now spinning because it is by the merry old Coldstreams. You can have it on H.M.V. C2602.

Or, if you have not forgotten *The Bohemian Girl* you might try C2605, which is a potted operatic version of it. It doesn't say who the soloists are, but you may take my word for it that they are all good.

Continuing with this selection business, Tom Jones has made an excellent job of Grieg's popular works. There are not too many of them, which is an advantage. It is silly to try to get the whole output of a man's life on to two sides of a record.

Shipmates o' Mine has been done as a sort of descriptive ballad in which Norman Allin and Raymond Newell are the soloists. It is quite good. Mind you, I don't say you will be sure to like it; it depends on your taste for such things (Col. DX550).

The same remark applies to *A Day in the Army* which is a Regal record (MR1060). Billy Cotton and his band are in this, together with a lively set of effects. It is difficult to be definite with records of this sort for the simple reason that it is so often a case of meat or poison. However, there are the numbers if you want to try them.

◆ ◆ ◆

Norman Long calls your attention to *'Oles*, and *We can't let you broadcast that*. You will have heard both in broadcast variety, so I need say nothing beyond the fact that the number of the Columbia issue is DB1216.

Another record you should not miss is Jack Hylton on Decca F3662, playing the *Wedding of the Rose* (charming) and *The Grasshoppers Dance*. This is easily the best Hylton issue that has come my way for a long time.

Now a little more seriously, but not too much so. You needn't be afraid of a work by Glinka or a Brandenburg Concerto by Bach as rendered on a Decca disc (LY6071).

To finish up with: *Die Meistersinger* overture with Adrian Boult conducting the B.B.C. orchestra (H.M.V. DB1924) and a magnificent symphonic synthesis of *Tristan and Isolda* by the Philadelphia Orchestra under Stokowski (H.M.V. 1911-14). It is entirely orchestral. I can only describe it as magnificent.

The Dance Music records are reviewed on page 560

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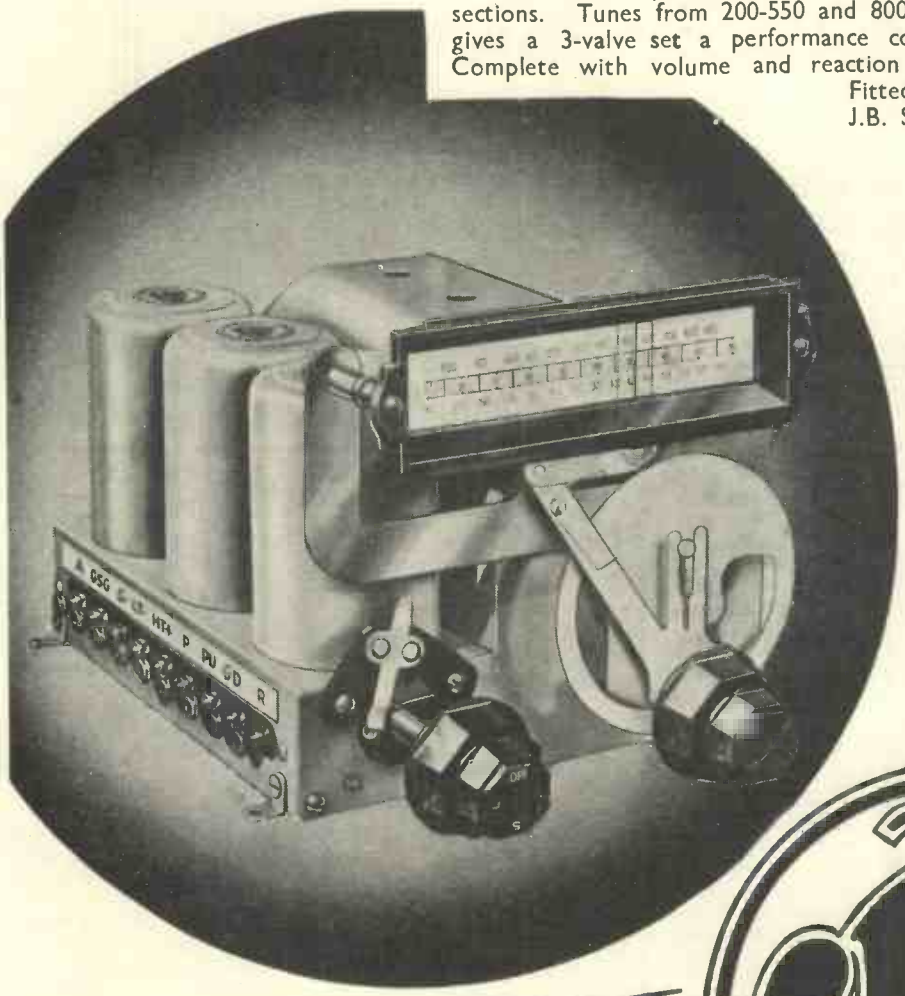

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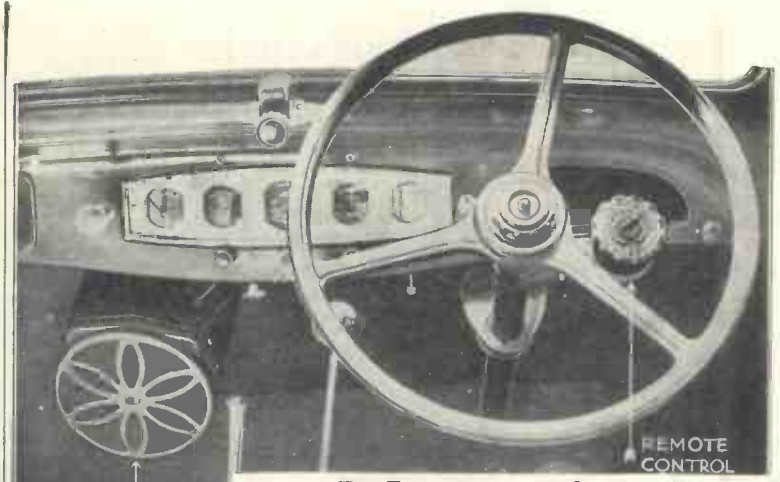

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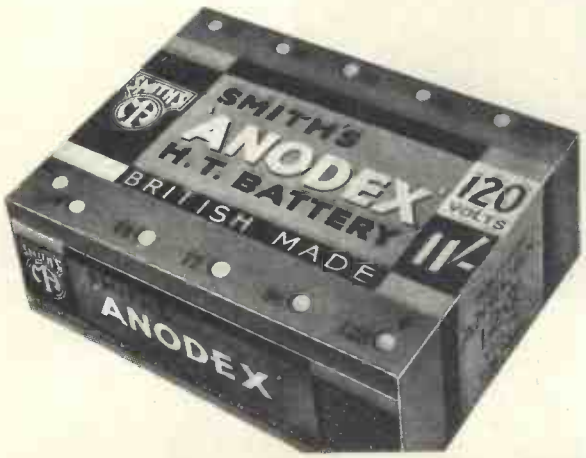

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Additional Records Reviewed

By CHOPSTICK

LIGHT SELECTIONS

(*a*) **Night and Day,** (*b*) **Medley of Cole Porter Hits,** Paul Whiteman and His Concert Orch., 4s. **H.M.V. C2606**

Cole Porter, the American composer, is very much in the news at the moment. His latest effort, *Gay Divorce*, is now safely installed at the Palace Theatre, after a successful try-out in Birmingham. *Night and Day*, which has the makings of a good seller, provided it is orchestrated carefully, is treated to a concert version here with Phil Dewey and the Pickens Sisters as vocalists. It is quite good entertainment, and I can safely recommend it. (*b*) is a medley of other Porter successes. It includes *What is This Thing Called Love*; *You do Something to Me*; and *You've Got That Thing*. Rather delicate jazz, I think, with a limited appeal.

Rhapsody in Blue (d.s.), Frank Black and His Orch., 4s. **BRUNS 123**

Still another version of George Gershwin's famous "jazz" classic, which, you remember, was originally played by Paul Whiteman's band in the film *King of Jazz*. This version under review, perhaps not quite so brilliant as some, is a colourful affair. Oscar Levant, the piano soloist, does his piece well. One gets the opportunity of hearing more solo work here. Recording is good.

INSTRUMENTAL

(*a*) **In the Valley of the Moon,** (*b*) **Isn't it Heavenly,** The Eight Pianos Symphony, 1s. 6d. **DECCA F3661**

You remember the broadcast of the eight pianos conducted by Harold Ramsay from the stage of the Granada, Tooting. I thought the show was excellent entertainment, and this record really does revive the experience. You know the tunes; both are well-established dance favourites.

(*a*) **Blackpool Song Mixture (No. 5)** (d.s.), Organ Solo by Reginald Dixon, 1s. 6d. **REGAL-ZONO MR1056**

"Fireworks" Reginald lets off the crackers and squibs of his Wurlitzer in this light, breezy medley. The tunes here are all tried favourites. You know Dixon's style by his frequent broadcasts. Here is a selection of tunes from this medley: *I've Found the Right Girl, Don't Blame Me, At the Old Pig and Whistle* are the best.

LIGHT SONGS

(*a*) **Dusty Shoes,** (*b*) **Night and Day,** Leslie Hutchinson, 2s. 6d. **PARLO R1647**

I wish we had more of Hutch in the wireless programmes; he is one of the best coloured singers of light songs in the country. These two songs are of the negro-spiritual fox-trot style with sentimental sections in the middle. Hutch always accompanies himself on the piano; remarkably well, too. Harry Roy's band helps him along in (*a*). Quite an interesting disc, which is well recorded.

(*a*) **I've Got to Pass Your House to Get to My House,** (*b*) **Blue Prelude,** Bing Crosby, 2s. 6d. **BRUNS 1577**

The "King of Crooners" at his best—or worst, as some people would say. He is sentimental and gloomy here on both sides. It is in these really miserable records that he is at his best. (*a*) is from the film, *Paradise Revue*. I am sure these numbers will reduce many of his ardent fans to tears. Very touching!

★(*a*) **Song of the Islands,** (*b*) **Heebie Jeebies,** The Three Keys, 2s. 6d. **BRUNS 1580**

The Three Keys—Bon Bon, Slim, and Bob—are really three very bright Negro boys and are—in my opinion anyway—the most versatile of present-day syncopated singers. One is an excellent pianist—modern, of course—another plays the guitar, and all of them sing. These two songs give them plenty of opportunities to show off their talent. *Heebie Jeebies* is real fire.

DANCE MUSIC

★(*a*) **It's Not a Secret Any More** (f.), (*b*) **Louisville Lady** (f.), Anson Weeks and His Orch., 2s. 6d. **BRUNS 1587**

Let me introduce Bob, the brother of the famous Bing Crosby. He is, I believe, making his first appearance on a dance record this side of the Pond. He is more "maleish" than Bing although, of course, he just hasn't got that way of his brother. Anson Weeks' band, in case you do not know it, is a peppy affair and makes merry with these tunes. You will enjoy the muted-trumpet playing on (*a*); it's really hot.

(*a*) **Love Looked Out** (f.), (*b*) **Happy and Contented** (f.), Ray Noble and His Orch., 2s. 6d. **H.M.V. B6407**

Ray Noble and Max Kester are jointly responsible for these numbers, which are taken from Kester's broadcast revue, *One Good Turn*, heard recently. Those of you who like soft dreamy type of sweet music will enjoy this. (*b*) is a duet about a happy pair who have found that elusive thing called love. Perhaps the right line for a Christmas disc. Both tunes are brilliantly orchestrated; could we expect anything else from Ray?

★(*a*) **Marvellous Tango** (tango), (*b*) **A Girl Like Nina** (tango), Geraldo's Gaucho Tango Orchestra, 2s. 6d. **COL CB668**

The record is described in the title. A delightful record in which time, melody and atmosphere are all there. (*a*) is a cleverly orchestrated affair, notable for some fine solo violin playing by Geraldo. (*b*), from *Ball at the Savoy*, the operetta which is having a huge success at the Drury Lane Theatre, is another rare number. Two very splendid efforts, which I thoroughly recommend.

★(*a*) **Night and Day** (f.), (*b*) **I've Got You On My Mind** (f.), Louis Reisman and His Orch., 2s. 6d. **H.M.V. B6398**

This is one of the star discs of the month. This is how I think (*a*) needs treating. It starts off rather like an Oriental fantasy, then we have the solo melody supported by string bass leading up to a delightful vocal by Fred Astaire. Admittedly it is rather of a sombre nature for Christmas time, but rather ideal for a dance when the lights are turned down. (*b*), also from *Gay Divorce*, is a brilliant affair.

★(*a*) **Snowball** (f.), **Dinner at Eight** (f.), Harry Roy and His Orch., 2s. 6d. **PARLO R1636**

There are only two essentials for a successful dance record for Christmas use: it must be lively and tuneful. Really time doesn't matter; the motor can always be accelerated or slowed down. Here is a Harry Roy record, which is a safe investment for Christmas use. Tuneful, bright and peppy are its features. (*b*) has caught on everywhere. Roy treats it in a skilful way, rather solidly, perhaps, but with plenty of piano twiddlybits which he plays himself. (*b*), a Carmichael tune, is recommended.

★(*a*) **The River's Takin' Care of Me** (f.), (*b*) **Trouble in Paradise** (f.), Casa Loma Orchestra, 2s. 6d. **BRUNS 1583**

If you are a regular listener you will remember the impersonation of this band by the B.B.C. orchestra in a recent programme depicting Henry Hall's experiences in America. They did not succeed, I thought. The Casa Loma is recognised as one of the finest five dance bands in existence. They have a style that is modern and precise, yet tuneful. This is a fine example of the band at their usual standard. (*a*) shows the fine precise team work, and (*b*) is extremely original. Recording is good.

(*a*) **Tick Tock** (f.), (*b*) **The Wedding of Mr. Mickey Mouse** (f.), Jack Hylton and His Orch., 1s. 6d. **DECCA F3669**

This is the type of record for the kiddies this Christmas. Jack Hylton puts all his best effects into the tune with the result that it is the ideal comedy number. On the other hand the grown-ups will enjoy it just as much.

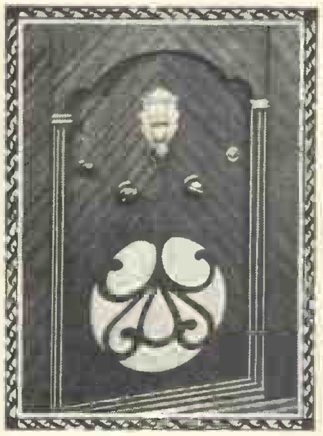
(*a*) **Trouble in Paradise** (f.), (*b*) **I Like to Go Back In the Evening** (f.), Jack Hylton and His Orch., 1s. 6d. **DECCA F3663**

I was really thunderstruck when I heard (*a*); it is so different to the usual boisterous style I expect from this band. He treats this tune, one of the best at the moment, in a quiet delicate way with a fine piano solo and well-sung vocal as the outline. (*b*) is quite different. It opens with a catchy vocal trio followed by the usual "brassy" tone.

(*a*) **Who's Afraid of the Big Bad Wolf?** (f.), (*b*) **Did My Heart Beat, Did I Fall In Love?** (f.), B.B.C. Dance Orch., directed by Henry Hall, 2s. 6d. **COL CB669**

It is really marvellous how a silly thing like (*a*) takes the public's fancy with the result that thousands of records are sold. The orchestration is queer, Les Allen singing about "piggywigs hey twiddle diddle," bleats by trumpets, squalls by trombones, all emphasise the foolishness of the whole affair. Yet it catches on. Henry Hall makes good fun of it; the kiddies will love it. The other tune on (*b*) is well done.

Here are two very popular artists who feature regularly in the Columbia lists. On the right is Howard Jacobs, a famous saxophonist whose personal salary as leader of his band at the Berkeley Hotel is no less than £100 per week. The other artist is Sidney Torch, the capable organist of the Regal Cinema, Marble Arch. His contribution to the Columbia lists this month is a fine organ record called "Hotter Than Ever." "Canadian Capers," "St. Louis' Blues" and "Somebody Stole My Gal" are the best numbers in the medley. (Columbia DB1210).



The Seventy-seven Super was described last December in the "Wireless Magazine," and is a one-knob control superhet radio-gramophone, capable of receiving over seventy foreign stations. This article shows how to add automatic volume control

ADDING AUTOMATIC VOLUME CONTROL to the SEVENTY-SEVEN SUPER

MANY will remember the Seventy-seven Super as an ambitious seven-valve all-electric set that was capable of bringing in almost any station that was worth hearing.

Unfortunately, however, many distant programmes are rendered valueless as entertainment because of excessive fading, but, as the set has a high H.F. magnification it is a relatively simple matter to add a form of automatic gain control. This will tend to counteract fading and will enable you to tune in all stations both near and far at practically the same strength.

Examination of the circuit shows that it is a comparatively simple matter to replace the present detector by a duo diode valve. One anode of this duo diode can then be used for detection and the other can be connected to give an automatic biasing voltage.

In order to make the conversion clear I have reproduced herewith the detector and first low-frequency circuit of the Seventy-seven Super (Fig. 1). It will be noticed that in the original set a triode was used, and diode rectification took place between grid and cathode.

In Fig. 2 is shown the revised detector and low-frequency circuit, making use of a duo diode for detection and A.V.C.

The part of the circuit shown in thin line corresponds to the original diode circuit shown in Fig. 1 and very few alterations to the wiring have been made.

The part of the diagram in heavy line shows how the other anode of the duo diode is connected to give automatic volume control. The rectified voltage developed across the 1-megohm resistance R when a signal is tuned in is used for biasing the grids of the various H.F. valves and so varies the magnification of the set inversely with signal strength.

In order to avoid the loss in sensitivity on small signals that simple automatic volume control invariably gives, the automatic volume control diode is rendered inoperative for small inputs by giving it a small negative biasing potential.

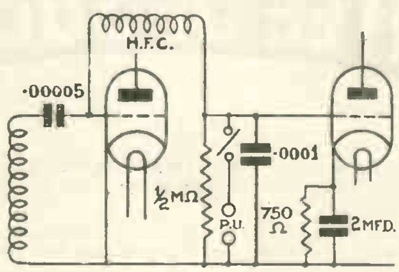


Fig. 1. The detector and first low-frequency stages of the Seventy-seven Super. A triode is used and diode rectification takes place between the grid and cathode

Operation of the set is quite simple. The 10,000-ohm high-frequency volume control should be set to the condition of maximum amplification compatible with stability when listening to a distant station. After the best preliminary setting for this control has been found, it should not need further adjustment, as the A.V.C. will automatically adjust the sensitivity of the set to the power of the station being received. Any further control that is needed should be carried out by means of the low-frequency volume control.

S. R. W

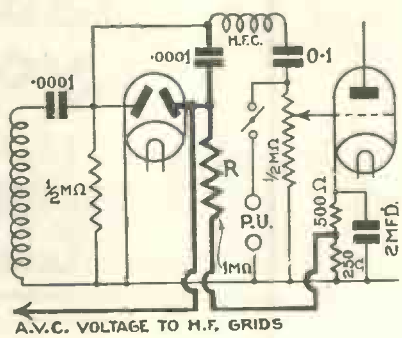


Fig. 2. The revised detector and low-frequency circuit with a double diode used for detection and automatic volume control

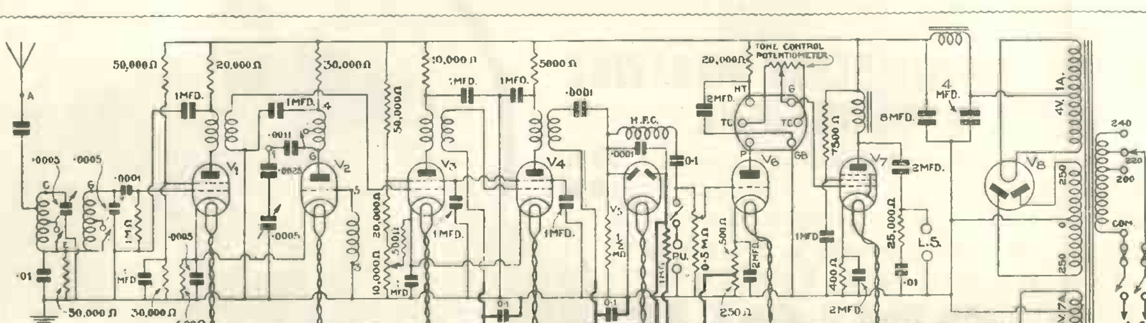


Fig. 3. The complete circuit diagram of the Seventy-seven Super with the automatic volume control arrangements fitted. It will be seen that the modification is very easily carried out

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SUPERIAL is too costly to IMITATE

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Compare any other Aerial with Superial and you will realise the poor quality of the ordinary outer covering—examine more closely and you will discover that the imitation is made up entirely without the essential rubber vulcanization — therefore without protection. Get Superial and be safe—it costs only a little more, but is worth more than double. Then, of course, there is the extraordinary efficiency of the scientific combination of ferrous and non-ferrous metals (including copper) far superior to the copper only Aerial.

Look at the illustrations below. The greatly enlarged photograph shows Superial with its seven strands completely encased from end to end with **extra heavy vulcanized rubber insulation,** so thick, it is actually like a rubber tubing. This insulation is then protected with heavy braiding and finally compounded and waxed to resist every condition of weather—**hot or cold, all the year round for many years to come.**

THE AERIAL WHICH MADE BROADCASTING POPULAR
SUPERIAL
ELECTRON'S SUPER-AERIAL

100 ft. 3/6 : 75 ft. 2/6 : 50 ft. 1/9 : 25 ft. 1/-

From Dealers everywhere.

BEWARE OF IMITATIONS

LOOK AT THE NAME AND THE BOX

Scientific combination of highly conductive ferrous and non-ferrous soft metals.

Thick vulcanized rubber insulation, a real protection against corrosion.

Complete protection is ensured with Flax braiding, heavily waxed and compounded

£500 FREE LIGHTNING INSURANCE FOR 2 YEARS

LOOK AT THIS POOR IMITATION. A piece of ordinary covered Aerial. The cheap cotton "covering" is not true insulation, neither is it a protection against corrosion or lightning. It quickly perishes on exposure, becomes unravelled and serves no useful purpose. Do not confuse it with vulcanized rubber insulation, which is a perfect protection.

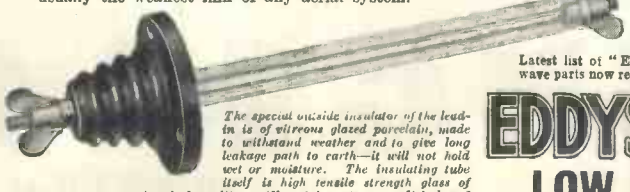
The NEW LONDON ELECTRON WORKS Ltd.
67 EAST HAM LONDON.E.6

IMPROVE YOUR SHORT WAVE RESULTS

SHORT-WAVE ENTHUSIASTS will welcome this "EDDYSTONE" high efficiency lead-in device. It makes sure that weak short-wave signals from thousands of miles away are carried safely to the set without loss at the point of lead-in —usually the weakest link of any aerial system.

"EDDYSTONE" LOW LOSS LEAD IN CAT. No. 946, Price 2/6.

Latest list of "EDDYSTONE" short wave parts now ready, free on request.



The special outside insulator of the lead-in is of vitreous glazed porcelain, made to withstand weather and to give long leakage path to earth—it will not hold wet or moisture. The insulating tube itself is high tensile strength glass of electrical quality. All metal parts are polished and nickel plated. Also suitable for use with transmitters.

EDDYSTONE
LOW LOSS LEAD IN

STRATTON & CO., LTD., BROMSGROVE ST., BIRMINGHAM.
London Service Depot—WEBB'S RADIO STORES, 164 Charing Cross Rd., W.C.2

MORE ABOUT

The Super-straight Six

—the fine six-valve receiver introduced in "W.M." last month

by W. JAMES

THE selectivity of a set depends upon the coils, tuning condensers and the circuit. When they are good and the ganging is carried out correctly, the tuning is bound to be sharp.

This set actually has very selective tuning because the parts used are good. But the better the parts the more accurately must the ganging be adjusted or the results will fall short of expectations. Now the tuned circuits were divided into two sections to help matters.

It is certainly easier to gang two separate two-gang condensers and to have satisfactory results than to rely entirely upon a single four-gang unit. It is possible to gang by making adjustments and to listening to weak signals. Always turn back the volume control in order to make the station being received as weak as possible. Then a slight change in the tuning will produce a result which can be heard.

You cannot notice slight changes when the signal is strong, so make it so weak that you can only just hear it. Then attend to one of the two-gang condensers. Adjust the trimmers very carefully, but always, when possible, use the smallest capacity in the trimmers. To do this, unscrew the trimmers as much as possible, tuning to the signal by adjusting the main control knob. Then make the signal as strong as possible by adjusting the trimmers.

The tuning range is extended by using the least fixed capacity in the circuit. Carry out tests, first with one two-gang circuit then the other. Afterwards go to a different signal and try again. As a rule, though, if the circuits are properly adjusted at a low wavelength there is no need to make further adjustments at a longer wavelength.

One thing is quite certain. If the trimmers have to be altered to get the best results when going from, say, 250 metres to 450 metres, then there is something wrong. A very slight alteration is allowable, so long as the average results over the whole range are good. But if tests show that a material difference in the results is obtained by altering the trimmers as between, say, 250 and 450 metres, then it is safe to say that either a coil is not matched with the others or one section of the gang condenser is not quite accurate.

If you should be unfortunate enough to find this state of affairs, then it would be advisable to ask the makers to test both sets of components rather than to try to put matters right yourself.

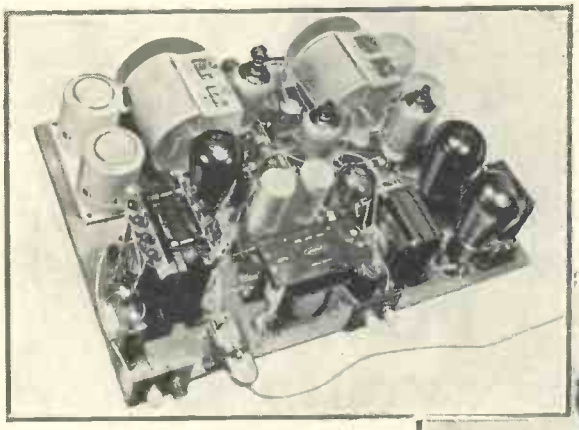
Pentode Detection

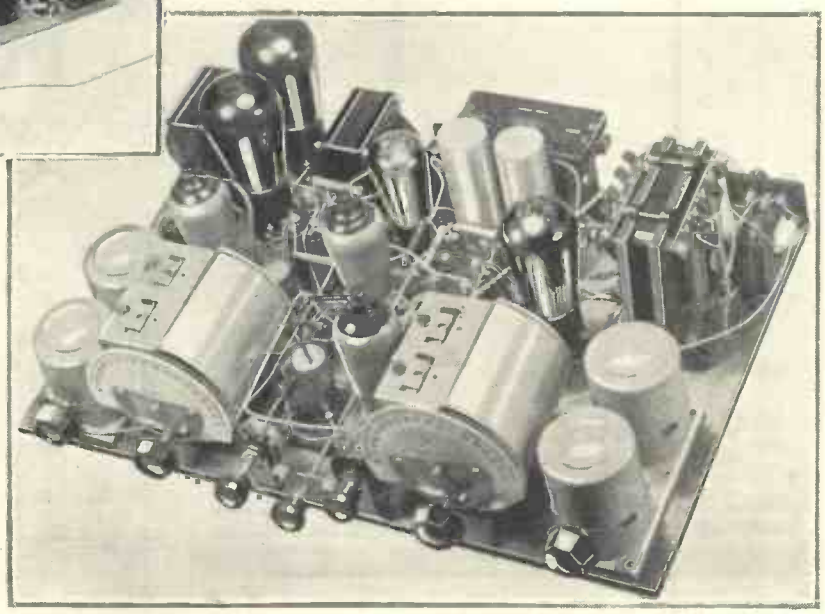
More accurate results are, I always think, obtained by connecting a low-reading milliammeter in the anode circuit of the detector. You will note that a pentode is used for detection, having a high resistance in the anode circuit. Further, it works as an anode bend detector. Therefore, the normal anode current is only a fraction of a milliampere. It increases as a signal is received, and the stronger the signal the greater the increase in current.

Making use of this fact we can tune to a station and adjust the ganging to produce the greatest reading. It is possible to obtain very fine quality from this set.

The two volume controls help. We can apply to the detector signals of such strength that it is not overloaded but yet is working with the least distortion. Then the output sound can be regulated by adjusting

Continued on page 572





A FINE SET CHASSIS

A rear view of W. James' Super-straight Six chassis is shown above, while the front view on the right shows the controls

Discard that unsightly mast and wires and fit the AIRCLIPSE. The selectivity of your set will be amazingly improved—each programme separately sharp and clear. The AIRCLIPSE is an auto-inductive aerial that filters incoming signals. It is not just another gadget—not a condenser. Fits inside or outside the set in any convenient place. Non-directional. Makes any set "portable." (For A.C. Mains or Battery Sets).

A delighted purchaser writes, "I have taken down my outside aerial as the reception I get with the AIRCLIPSE is better, infinitely clearer, and free from crackle."

The AIRCLIPSE 5/-
PROVISIONAL PAT 9377/33
AUTO-INDUCTIVE AERIAL

Of all radio dealers or direct from—*AIRCLIPSE, LTD., 182 Vauxhall Bridge Rd., LONDON, S.W.1. Tel.: Victoria 5022*

MORE ABOUT THE LOUDOSCOPE

The **HARTLEY-TURNER** loud-speaker was designed to eliminate, as far as possible, resonances and other defects of performance which would impair reproduction. We found that certain materials used in a certain way gave certain results; those results are the **HARTLEY-TURNER.** If we used the same materials in any other way, or other materials in any way at all, results were inferior by actual test. We had no pre-judices, nor did cost affect the question at all; we just wanted the best possible speaker. Regarding the Loudoscope . . . Well it isn't our fault that they look different AND sound different.

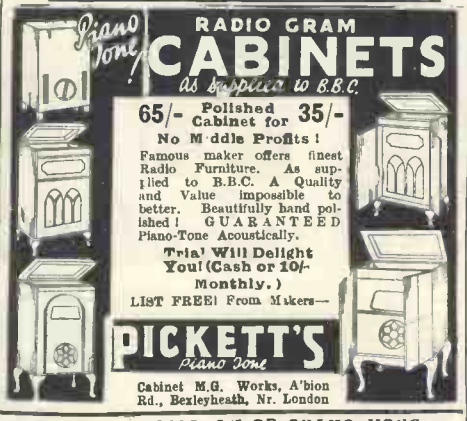
HARTLEY - TURNER

the Analytic loud speaker,

D.C. MODEL **7** Gns. A.C. MODEL **8** Gns.

"New Notes in Radio," sent for 1½d. stamp, will tell you all sorts of interesting things.

HARTLEY TURNER RADIO Ltd.,
Thornbury Road, Isleworth, Middlesex
Telephone : Hounslow 1854.



CLASS 'B' MAINS UNITS

Heayberd were the first manufacturers to incorporate the Cossor Neon Stabiliser Tube in their Class "B" Mains Units. This is the only satisfactory method of obtaining Constant Voltage Regulation irrespective of the current taken from the Unit, between 5-50 m/A. Two units are available, one for A.C. and one for D.C. Both units provide an output of 120-130 v. at 5-50 m/A. Exceptional smoothing.

A.C. MODEL (Not including Stabiliser Tube) Price 97/6
D.C. MODEL (Not including Stabiliser Tube) Price 55/-
(Cossor Neon Stabiliser Tube is priced at 7/6)

POST COUPON NOW

I enclose 3d. in stamps for copy of Handbook (36 pages) on how to build my own Mains Unit, and packed with hints, tips and circuit diagrams.
Mr. .....
Address .....
.....

HEAYBERD
MONARCH OF THE MAINS.
10 FINSBURY STREET, E.C.2

"We're Fluxite and Solder—the reliable pair; Famous for Soldering—known everywhere!

The set is now working—just like NEW! Without Fluxite and Solder—What *would* you do?"

See that Fluxite and Solder are always by you—in the house—garage—workshop—anywhere where simple, speedy soldering is needed.

ALL MECHANICS *WILL* HAVE
FLUXITE
IT SIMPLIFIES *ALL* SOLDERING

All Ironmongers sell Fluxite in tins: 4d., 8d., 1s. 4d., and 2s. 8d. Ask to see the FLUXITE POCKET SOLDERING SET—complete with full instructions—7s. 6d. Ask also for our leaflet on HARDENING STEEL with Fluxite.

Fluxite Ltd., (Dept. 332), Rotherhithe, S.E.16

FOR *ALL* REPAIRS!

MAKE A RADIOGRAM OR GRAMOPHONE

Our 64-page Illustrated List for 3d. will tell you how and show you a great variety of Spring and Electric Motors, Turntables, Tonearms, Soundboxes, Horns, Loud-speakers, Pick-ups, Cabinets, hinges, lidstays, doorlocks, knobs, handles, and catches. Also Receivers, Kits, complete Gramophones, accessories, springs, needles, and repair parts at lowest prices; w'sale or retail. Est. 30 yrs.

The Regent Fittings Co. (W.M.), 120 Ol St., London, E.C.1

Micromesh TRADE MARK
THE MODERN VALVE

Literature and prices on request

Standard Telephones and Cables, Ltd., St. Chad's Place, 364 Gray's Inn Road, London. W.C.1. *Terminus 6255*

STATION HETERODYNING

"KINVA" WHISTLE AND "SPLASH" FILTERS ARE FULLY EFFECTIVE IN CUTTING OUT STEADY WHISTLES OF HIGH PITCH WITHOUT AFFECTING TONE QUALITY. DESIGNED FOR ALL SETS, FOR SIMPLE CONNECTION IN DETECTOR OR L.F. ANODES.

Type A3. Two-Coil Filter 13/6
„ 'D.' Single-Coil do. 7/6

KINVA TRADE MARK

Complete details of Filters; latest type Screened H.F. Chokes; Tone Corrector Coils; S.W. Chokes on receipt of stamp.

POSTLETHWAITE BROS.,
Dept. C, KINVER, STOURBRIDGE

HAVE YOU HAD particulars of the famous "Magnum" Short Wave Adaptor, which is now available for every type of receiver?

Full particulars, with a list of short-wave stations and free trial offer, on request.

BURNE-JONES & CO. LTD.,
296 Borough High St, London, S.E.1

Buy
"AMATEUR WIRELESS"
3d. Weekly

FOR HIRE
FULLY EQUIPPED PUBLIC ADDRESS VAN
Sent anywhere in British Isles, also **RADIO, MICROPHONE, & GRAMOPHONE AMPLIFIERS** giving exceptional quality and volume, suitable for Dances, Sports Meetings, Fetes, etc. from 15/- per day. McMichael Portable Sets 15/- a week; £2/12/6 a month.

ALEXANDER BLACK, LTD
WIRELESS CONSULTANTS
55, EBURY STREET, LONDON, S.W.1.
ESTABLISHED IN 1925
SLOANE 1655.
Trade Inquiries Invited.

SERVICE
SETS OF ALL TYPES
Supplied, Serviced and Visited in any district, or may be sent for Full Test and Report, at 2/- per valveholder; portables 1/6 per valveholder.

There is news in the "Wireless Magazine" advertisements

Fine Results with W. James' New Set

Continued from page 568

the low-frequency volume control. I find that the full low-frequency is seldom required, but it is there for dealing with very weak signals. This control is, of course, of value when playing a pick-up.

"Top" Control

It should be noted that the strength of the high notes, when playing a record, may be adjusted by connecting a condenser or a scratch filter across the pick-up itself. The quality is adjusted for radio, and if the quality from a pick-up is not quite right, then this must be adjusted between the pick-up and the set.

Actually I found the quality very good, but I know how pick-ups vary and for some reason or other many people like really good radio quality, but seem to want no top (high-notes) when playing records. This is best arranged between the pick-up and the set.

The set gives enough power to drive more than one loudspeaker, but the ratio of the transformer coupling the output valves and the loudspeakers must be adjusted to suit. If this is not done, the quality and volume will suffer. Note that as an output transformer is fitted in the set, the loudspeakers used must not have transformers. There is a fair amount of heat generated by the power valves and the rectifier. Therefore do not use a back to the cabinet without holes for ventilation. The back should not be of solid wood in any case, as the output from the loudspeaker would sound muffled.

Don't Take Risks

In a set of this class it is advisable to keep to the parts and valves recommended. It is always possible to make slight changes in such things as valve holders, fixed condensers, chokes and transformers. But one can never tell what will happen when inferior parts are used.

Be particularly careful of the various fixed resistances. Test them if possible, as I have had wrongly marked ones at various times. They are easily tested using a milliammeter and a battery, the resistance being obtained by dividing the voltage by the current. For example, with 9 volts and a current of 9 milliamperes the resistance is 1,000 ohms. Always check the bias resistances, and if you cannot do this, have them tested when purchasing.

Any set is the better for a good aerial and earth. The earth is often neglected, but is very useful in two respects, first it improves the wireless reception, and secondly it tends to stop faint mains noises. Always try a good earth.

The aerial, too, is important, and the difference between a good and a poor one sometimes amounts to as much as one H.F. valve, apart from this, a good aerial as compared with a bad one may make all the difference between good clear reception and difficult and perhaps noisy reception.

The set itself has all the selectivity needed, so do not use a poor aerial to help selectivity. A short aerial is not necessarily a poor one. I have found that the set brings in all the decent stations, and there is a reserve of power and sensitivity.

COMPONENTS NEEDED for the SUPER-STRAIGHT SIX

	£	s.	d.
BASEBOARD			
1—Peto-Scott 20¾ in. by 14 in.	0	2	6
CHOKES, HIGH-FREQUENCY			
2—Wearite screened with pig-tails, type HFPA (or Goltone, Bulgin)		8	0
CHOKE, SMOOTHING			
1—Davenset, type No. 102 (or Kinva, Parmeko)	1	2	6
COILS			
1—Set Colvern, types F1 and F2, mounted on metal base ...	1	5	0
1—Set Colvern, type F14 (two), mounted on metal base ...	1	5	0
CONDENSERS, FIXED			
2—Dubilier .0001-microfarad, type 670 (or T.C.C., Telsen) ...	0	2	0
1—Dubilier .002-microfarad, type 670 (or T.C.C., Telsen) ...	0	1	3
1—Dubilier .01-microfarad, type 670 (or T.C.C., Telsen) ...	0	2	0
2—T.C.C. .015-microfarad, type 50	0	3	6
8—Dubilier .5-microfarad, type BB (or Lissen, Peak)... ...	1	0	0
3—Dubilier 2-microfarad, type BB (or Lissen, Peak)... ...	0	10	6
2—Dubilier 8-microfarad electrolytic (or Peak, T.C.C.) ...	0	11	0
CONDENSERS, VARIABLE			
2—Utility twin-gang .0005-microfarad, type W314/2, with covers and disc drives ...	1	15	0
HOLDERS, VALVE			
7—Benjamin 5-pin (or Telsen, W.B.)	0	5	10
RESISTANCES, FIXED			
2—Erie 250-ohm (or B.A.T., Graham-Farish)	0	2	0
1—Erie 300-ohm (or B.A.T., Graham-Farish)	0	1	0
1—Erie 1,000-ohm (or B.A.T., Graham-Farish)	0	1	0
1—Erie 2,000-ohm (or B.A.T., Graham-Farish)	0	1	0
2—Erie 3,000-ohm (or B.A.T., Graham-Farish)	0	2	0
2—Erie 5,000-ohm (or B.A.T., Graham-Farish)	0	2	0
2—Erie 10,000-ohm (or B.A.T., Graham-Farish)	0	2	0
2—Erie 20,000-ohm (or B.A.T., Graham-Farish)	0	2	0
1—Erie 50,000-ohm (or B.A.T., Graham-Farish)	0	1	0
1—Erie 1-megohm (or B.A.T., Graham-Farish)	0	1	0
1—Erie 2-megohm (or B.A.T., Graham-Farish)	0	1	0
RESISTANCES, VARIABLE			
1—Claude Lyons 5,000-ohm potentiometer and combined switch, type P185/M5/S ...	0	7	6
1—Claude Lyons ¼-megohm potentiometer, type ST/250 ...	0	6	6
SUNDRIES			
2—British Radiogram 2-in. metal mounting brackets (or Wearite)	0	1	0
1—British Radiogram metal mounting bracket to specification	0	0	6
2—Peak brackets for mounting electrolytic condensers ...	0	1	0
2—Sovereign terminal mounts ...	0	1	0
1—Bulgin duplex needle-cup, type NC1	0	2	0
Round tinned copper wire for connections (Lewcos), say ...	0	0	9
Oiled sleeving (Lewcos), say ...	0	1	6
3 yds. thin flex (Lewcoflex), say	0	0	3
1—Bulgin combined mains plug and fuse holder, type F.15 ...	0	3	0
SWITCHES			
1—Bulgin two-way toggle, type S.81B, with extension rod 6 in. by $\frac{5}{32}$ in.	0	2	2
1—Bulgin on-off rotary toggle, type S91.LB	0	2	0
TERMINALS			
4—Clix, marked Aerial, Earth, Pick-up (two) (or Belling-Lee, Eelex)	0	1	4
TRANSFORMERS, LOW-FREQUENCY			
1—Ferranti inter-valve, type AF6C	1	14	0
1—Ferranti output, type OPM6C	1	6	6
TRANSFORMER, MAINS			
1—R.I., with following windings: 300-0-300, 120 milliamps; 2-0-2, 2 amperes; 2-0-2, 2 amperes; 2-0-2, 4 amperes	2	12	6

ACCESSORIES

CABINET			
1—Osborn, in mahogany, type No. 265	6	5	0
GRAMOPHONE MOTOR			
1—Garrard A.C., model 202A ...	2	10	0
LOUD-SPEAKER			
1—W.B., type PM1, without matching transformer (or Rola, Blue Spot)	5	5	0
PICK-UP			
1—B.T.H. Minor, with combined volume control (or Blue Spot, Harlie)...	1	5	0
VALVES			
2—Mullard VP4 (metallised) ...	1	15	0
1—Mullard SP4 (metallised) ...	0	17	6
1—Mullard 104V	0	14	0
2—Mullard ACO44	1	13	0
1—Mullard DW3	0	15	0

The Super-straight Six, W. James' latest receiver, was described on page 360—364 of last month's issue. A quarter-scale reproduction of the baseboard layout was given on page 362, but a full size blueprint, No. W.M. 339, is obtainable, price 1s. 6d. post paid, from the WIRELESS MAGAZINE Blueprint Department, 58-61, Fetter Lane, London, E.C.4.

SUNBEAM MIDGET

Universal Mains Receiver, A.C. or D.C.

A MASTERPIECE IN MINIATURE

The "Multum in Parvo" of Radio

Here is a real midget receiver . . . a personal set that is portable . . . a midget set 8 in. high and 10½ in. wide, which is having big sales. This is an all-electric set working off either A.C. or D.C. mains. It has 4 TUNGSRAM Universal valves (2 screen grid, pentode and rectifier), specially selected full-sized moving-coil speaker, volume control and on-off switch, one knob tuning marked in wavelengths, operating on long and short wavebands, and is entirely self-contained in an attractive walnut cabinet. Such outstanding value has never before been available; and, **although the set is so remarkably compact, the quality is exceptional, and each receiver is backed by a 12 months' guarantee. Sold through appointed agents only.**

Send P.C. for address of nearest agent and descriptive literature.

The Sunbeam "Midget" and another outstanding Sunbeam receiver—the 4-valve Universal Electric U.35—are reviewed on pages 10 & 12 of "Choosing your New Radio"

COMPLETE—NO EXTRAS

SUNBEAM RADIO

7 GNS or deferred terms

ANNOUNCEMENT OF SUNBEAM ELECTRIC LTD., PARK ROYAL ROAD, LONDON, N.W.10

Telegrams: Sunberad, Harles, London. Telephone: Willesden 1575 (5 lines).

NICORE

A.V.C. UNIT

The Varley Nicore automatic volume control unit can be fitted to any receiver having one or more variable-mu S.G. Valves. Connected immediately after the detector valve (second detector with Superhets) in place of the H.F. choke. Easily inserted into the circuit, only four connections being necessary.

BP27 ... ... 15/6

AND THE

POWER PUNCHER

The new Varley "Power Puncher" is easily incorporated in most battery sets. Gives greater volume with lower H.T. current. Requires no special transformers or valves.

DP44 ... ... 15/9

Varley
(Proprietors: Oliver Pell Control Ltd)

Write to us to-day for full particulars of the whole range of Varley Components.

Advert. of Oliver Pell Control Ltd., Kingsway House, 103 Kingsway, W.C. 2 'Phone: Holborn 5303.

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.

CRYSTAL SET (6d.)

1931 Crystal Set	AW308

ONE-VALVE SETS (1s. each)

Easy to Build One	AW304
Portable Short-wave One	AW354
B.B.C. One-valver	AW387

TWO-VALVE SETS (1s. each)

A Two for 7 Metres (D, Trans)	WM295
New-style Radiogram (D, Trans)	WM299
A.C. Quality Gem (D, Trans)	WM312
Ideal Regional 2 (D, Trans)	AW357
Quality 30s. Two (D, Trans)	AW361
Ether Music Two (D, Trans)	AW364
Clarion-volce 2 (SG, D, Pen)	AW371
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

THREE-VALVE SETS (1s. each)

Three-Range Three (SG, D, Pen)	WM336
Economy-pentode Three (SG, D, Pen)	WM337
Simplicity A.C. Radiogram (SG, D, Pen)	WM338
D.C. Calibrator (SG, D, Push-pull Pen)	WM328
Tyers Iron-core Three (SG, SGD, Pen)	WM330
A.C.-D.C. Three (SG, D, Pen)	WM332
I.C.B. Three (D, LF, Class-B)	WM333
Duo-tuned Three (SG, D, Pen)	WM341
£8 Radiogram (D, RC, Trans)	AW343
Wizard (SG, D, Trans)	AW360
£2 2s. Family Three (D, 2 Trans)	AW368
Build As You Learn Three	AW366
Build As You Learn SG3 (SG, D, Trans)	AW372
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

FOUR-VALVE SETS (1s. 6d. each)

Quadradyne (2 SG, D, Pen)	WM273
A.C. Quadradyne (2 SG, D, Power)	WM279
Ideal A.C. Home Super (Super-het)	WM290
Gold Coaster (A.C. Short-waver)	WM292
Triple-tune Four (2 SG, D, Trans)	WM293
Calibrator (SG, D, RC, Trans)	WM300
Table Quad (SG, D, RC, Trans)	WM303
"Words and Music" Radiogram (2 SG, D, Trans)	WM307
Home Short-waver (SG, D, RC, Trans)	WM311
"Words and Music" Radiogram de Luxe (SG, D, RC, Q.P.P.)	WM307a
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
Melody Ranger (SG, D, RC, Trans), with copy of "A.W." 4d. postage	AW375
"A.C. Melody Ranger" (SG, D, RC, Trans)	AW380
"A.W." Ideal Four (2SG, D, Pen)	AW402

FIVE-VALVE SETS (1s. 6d. each)

Super-quality Five (2 HF, D, RC, Trans)	WM320
Ideal Home Super (Super-het)	WM280
Easytune 60 (Super-het)	WM284
New Class-B Five (SG, D, LF, Class-B)	WM340
James Short-wave Super (Super-het)	AW328
Simple Super (Super-het)	AW340
The Etherdyne (Super-het)	AW406

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
Connolsseurs' Super (A.C. Super-het)	WM334
James Super Straight Six (2 SG, D, LF, Push-pull)	WM339
New Century Super (Super-het), with copy of "A.W." 4d. post free	AW363
New A.C. Century Super (A.C. Super-het)	AW365

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
General-purpose Portable (SG, D, RC, Trans)	AW351

MISCELLANEOUS (1s. each)

Voltage Regulator	WM287
Class-B Mains Unit	WM324
"A.W." Trickle Charger	AW352
Add-on Band-pass Unit	AW359
Plug-in Short-wave Adaptor	AW382

★

SPECIAL HALF-PRICE OFFER

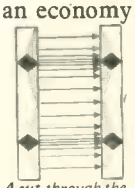
Blueprints of the following "Wireless Magazine" sets described in this issue are obtainable at the special price, given below, if the coupon on last page is used before Dec. 31, 1933.

Class-B Quadradyne (2 SG, D, LF, Class-B), WM344 ... ... 9d.

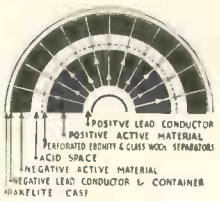
Merrymaker Super (4-valve A.C. super-het), WM345 ... ... 9d.

SHOULD YOU DISCARD YOUR OLD ACCUMULATOR?

MODERN factories courageously scrap any machinery, however new, that can be improved. It is an economy. Think of your accumulator this way. It can be improved out of knowledge. A section is shown here through the plates of your accumulator. Current naturally concentrates round the good-conducting (but inert) lead grids, so that the active material itself receives only a very uneven charge. That is why battery technicians have explored every means of eliminating these grids. To-day, in the modern Block cell, active material is formed round the interior of a lead cylinder, tough as a rock, without any grids at all. The improvements are obvious — (1) you ensure really complete charging (2) you increase the proportion of active material available (3) you save a lot of weight and space. It is not surprising that this new kind of accumulator lasts twice the time on each charge (a saving in money and bother that is alone worth while). A plan section of the new accumulator is shown here. One hundred thousand people are already benefiting from the new accumulator — not only has it double capacity, but it is far stronger and does not run down when inactive. Why not think this over?



A cut through the plates of an ordinary accumulator. The grey tone represents concentration of current round the grids (black).



BLOCK PLATELESS L.T. ACCUMULATOR TYPE B.80, 80a.h., 2v., 11/6

BLOCK
PLATE-LESS ACCUMULATORS

Block Batteries Ltd., By-Pass Road, Barking, Essex. Tel. Grangewood 3346.
TAS/Bb.71

JUDGE FOR YOURSELF

AT LAST—LOW PRICED LUXURY

Remember that Regentone achieve luxury receivers by putting the last ounce of craftsmanship into every detail—that is why Regentone sets are so dependable. Then look at the prices—see how **they** compare. Judge this year's Regentone receivers for yourself. The coupon below brings **free-of-charge** real photographic reproductions of Regentone receivers. Then visit your nearest Regentone stockist. He stocks the full range. There you will see and hear for yourself what we all seek—quality at a low price!

To REGENTONE LTD., REGENTONE WORKS WORTON ROAD, ISLEWORTH, MIDDLESEX

Please send me the real photographic reproductions of Regentone Sets, and the name of my nearest Regentone Stockist.

Name.....

Address.....

.....

BLUEPRINT COUPON

Valid only until Dec. 31, 1933 (or until Jan. 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 :—

TELEVISION TIME BASES (page 548), No. WM343, price 9d. post paid.

THE CLASS-B QUADRADYNE (page 494), No. WM344, price 9d, post paid.

POWER SUPPLY UNIT FOR TIME BASES (page 548), No. WM346, price 6d. post paid.

THE MERRYMAKER SUPER (page 474), No. WM345, price 9d. post paid.

INFORMATION COUPON

Valid only until Dec. 31, 1933 (or until Jan. 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.

Notes and Jottings

OWNERS of American sets will be interested to know that a new company has been formed for the particular job of servicing American-built receivers. The new company is the Henry Ford Radio of 56, Howland Street, Tottenham Court Road, London, W.1.

◆ ◆ ◆

The Page Car Radio two-valve set has many applications besides being used in a motor car. It is a little receiver using two bi-grids and only needs 12 volts high tension. It is ideal for headphone use or as a replacement for a crystal set, as it is undoubtedly one of the cheapest receivers to run that you could possibly obtain.

◆ ◆ ◆

We have been testing the Mazda AC2Pen, a highly efficient low-frequency pentode. It is capable of giving 3.6 watts with an input of only 2.6 volts. In practice, this means that full loud-speaker strength can be obtained from the pick-up without any other *valve* amplification. In a small receiver, following the detector valve, it will increase the volume from the weak foreign stations and make a lot of them suitable to drive a large speaker.

◆ ◆ ◆

The R.I. Automatic Volume Control unit at 15s. 6d. is a very useful component. It can be fitted in a moment in any receiver using two or more high-frequency stages, and it really does give a satisfactory degree of volume control—limiting the volume of the local station and overcoming objectionable fading.

◆ ◆ ◆

The French pilots, Rossi and Cordes, who recently broke the long distance non-stop flying record, by flying from New York to Rajak, which is a distance of approximately 5,700 miles, used Philips valves. Immediately on their arrival at Rajak, they sent the following wire to the European Headquarters of the firm. "Your valves were marvellous during the entire non-stop flight from New York to Rajak. Congratulations.—Rossi, Cordes."

INDEX TO ADVERTISERS

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