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with Complete Foreign Programmes

Friday, September 22nd, 1933.

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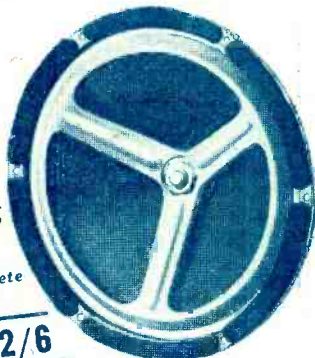
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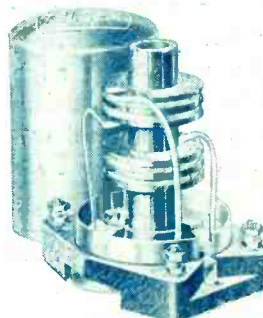
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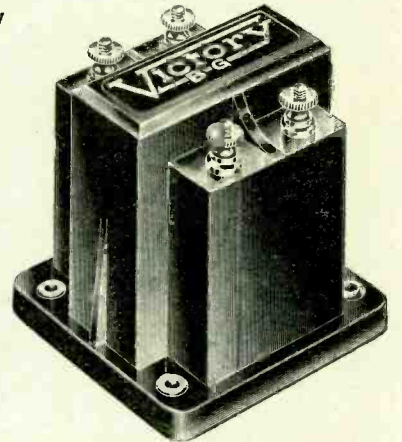
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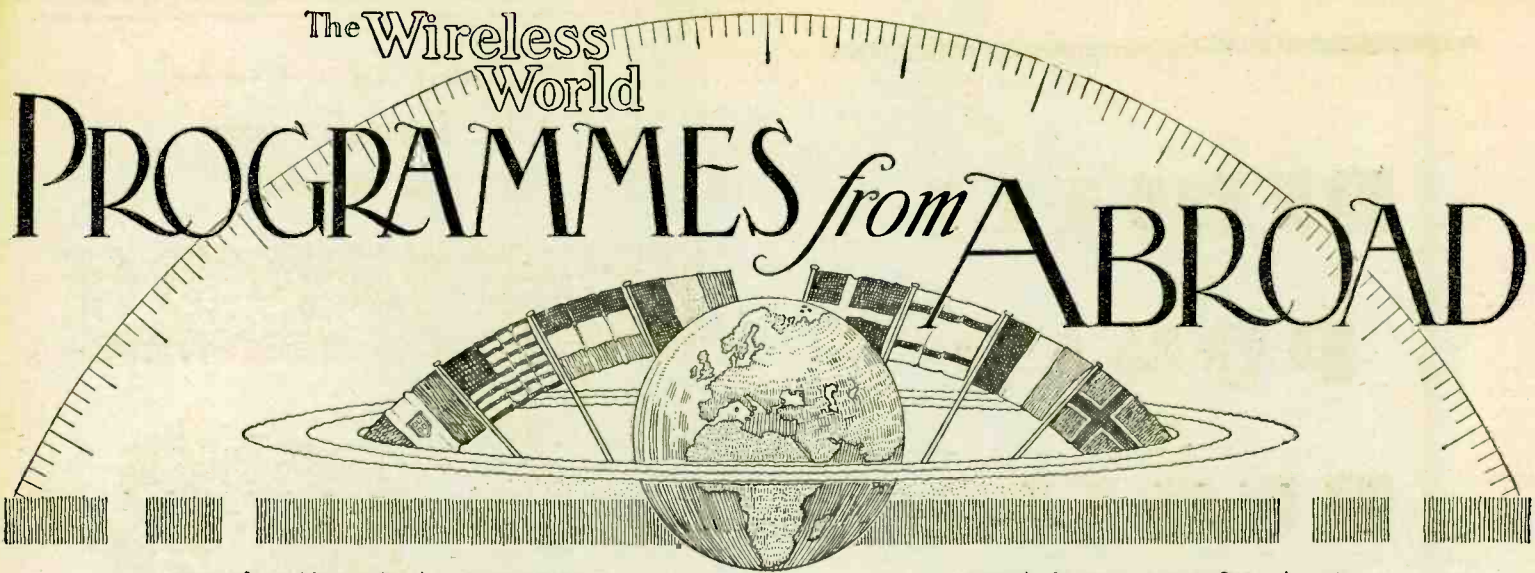
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BROADCASTING STATIONS
ARRANGED IN ORDER
OF WAVELENGTH

TIMES AND DETAILS OF
FULL WEEK'S FOREIGN
TRANSMISSIONS

Metres.	kc/s.	kW.	Station.	Tuning Positions.	Metres.	kc/s.	kW.	Station.	Tuning Positions.
1935	155	7	Kaunas (Kovno) (Lithuania)		453.2	662	0.25	Agen (France)	
1875	160	8.5	Hilversum (Holland) (<i>Kootwyk</i> , 50kW., after 3.10 p.m.) (V.A.R.A., A.V.R.O. and V.P.R.O. programmes.)		453.2	662	4	Milan (Vigentino) (Italy). (<i>Relays Rome</i>)	
					450.3	666	20	Madona (Latvia). (<i>Relays Riga</i>)	
1796	167	40	Lahti (Finland)		447.1	671		Paris, Ecole Supérieure, PTT (7.0 kW.); Rjukan (0.15 kW.); Notodden (0.08 kW.); Ålesund (0.35 kW.) (Norway) (<i>relays Oslo</i>).	
1725	174	75	Radio Paris, C.F.R.					Rome, I.R.O. (<i>S.-W. Station</i> , 2RO on 25.4 m.)	
1635	183.5	60	Berlin. (Deutschlandsender) (Germany). (<i>S.-W. Stn. DJA on 31.38 m., DJB on 19.73 m., DJC on 49.83 m., DJD on 25.51 m., DJE on 16.86 m.</i>)		441.2	680	50	Stockholm, SASA (Sweden)	
					435.4	689	55	Belgrade (Yugoslavia)	
1554.4	193	30	Daventry National		430.4	697	2.5	Madrid, EAJ7 (Union Radio)	
1538	195	7	Ankara (Angora) (Turkey)		424.3	707	2	Moscow, Inini Stalina (Russia)	
1481	202.5	500	Moscow, RVI (Old Komintern) (Russia)		424.3	707	100	Berlin, Funkstunde (Germany)	
1446	207.5	13	Eiffel Tower, FL, Paris		419.5	715	1.5	Rabat (Morocco)	
1412	212.5	120	Warsaw I (Poland)		416.4	720.5	5	Athlone (Irish Free State)	
1380	217.5	100	Novosibirsk, RV76 I (Russia)		413	725	60	Katowitz (Poland)	
1354.4	221.5	30	Motala (Sweden). (<i>Relays Stockholm</i>)		408.7	734	16	Sottens (Radio Suisse Romande) (<i>Switzerland</i>)	
1350	222	0.5	Tunis-Kasbah (Tunisia)		403.8	743	25	Midland Regional (Daventry)	
1304	230	100	Moscow, WZSPS (Trade Union) (Russia)		398.9	752	25	Bucharest (Roumania)	
1230	244	0.6	Boden (Sweden). (<i>Relays Stockholm</i>)		394.2	761	12	Leipzig (Germany)	
1200	250	5	Stamboul (Turkey)		389.6	770	120	Toulouse (Radiophonie du Midi) (France)	
1200	250	21	Reykjavik (Iceland)		385.1	779	8	Stalino, RV26 (Russia)	
1190	252	200	Luxembourg		385.1	779	10	Lwow (Lemberg) (Poland)	
1170	256	25	Tashkent, RV11 (Russia)		381	788	16	Scottish Regional (Falkirk)	
1154	260	75	Kalundborg (Denmark). (<i>Relays Copenhagen</i>)		376.4	797	50	Hamburg (Germany)	
1154	260	20	Monte Ceneri (Switzerland). (<i>Temporarily Closed</i>)		372.2	806	1.5	Radio, LL, Paris	
					370.1	810.5	0.8	Seville, EAJ5 (Union Radio) (1.0 kW.); Galicia EAJ4 (0.2 kW.) (Spain); Bolzano (1.0 kW.) (Italy); Helsinki (10 kW.) (Finland) (<i>relays Lahti</i>); Kharkov, RV20 (10kW.) (Russia).	
1117	268.5	40	Moscow, Popoff RV58 (Russia)		368.1	815	0.7	Fredrikstad (Norway). (<i>Relays Oslo</i>)	
1083	277	60	Oslo (Norway)		364.1	824	1	Bergen (Norway)	
1071	280	35	Tiflis, RV7 (Russia)		363.6	825	13	Algiers (Algeria)	
1035	290	36	Kiev, RV9 (Russia)		360.6	832	60	Mühlacker (Stuttgart) (Germany)	
1000	300	100	Moscow RV39 (Russia) (<i>S.-W. Stn. on 50 m.</i>)		355.9	843	50	London Regional (Brookmans Park)	
938	320	20	Kharkov, RV4 (Russia)		352.1	852	7	Graz (Austria). (<i>Relays Vienna</i>)	
857	350	100	Leningrad (Russia)		348.8	860	7.6	Barcelona, EAJ1 (Spain)	
840	357	18.5	Budapest (Hungary)		348.8	860	10	Leningrad, RV70 (Russia)	
825	363.6	50	Sverdlovsk, RV5 (Russia)		345.2	869	11.5	Strasbourg, PTT (France)	
760	395	1.3	Geneva (Switzerland). (<i>Relays Sottens</i>)		341.7	878	35	Brno (Brunn) (Czechoslovakia)	
720	416.6	20	Moscow, RV2 (Experimental) (Russia)		338.2	887	15	Brussels II, Velthem (Belgium). (<i>In Flemish</i>)	
690	434.6	1.5	Oulu (Uleaborg) (Finland)		335	896	5	Cadiz (Spain)	
680	441.2	0.6	Lausanne (Switzerland). (<i>Relays Sottens</i>)		334.4	897	1.9	Poznan (Poland)	
574.7	522	7	Ljubljana (Yugoslavia)		331.5	905	50	Milan (Italy). (<i>Relays Turin</i>)	
569	527	0.25	Freiburg-im-Breisgau (Germany). (<i>Relay Stn.</i>)		328.2	914	60	Poste Parisien (France)	
568.1	528	2	Grenoble (France)		325	923	60	Breslau (Germany)	
563	533	16	Wilno (Poland). (<i>Relay Station</i>)		321.9	932	10	Göteborg (Sweden). (<i>Relays Stockholm</i>)	
560	536	0.25	Augsburg (Germany). (<i>Relays Munich</i>)		318.8	941	0.25	Dresden (Germany). (<i>Relays Leipzig</i>)	
560	536	1.5	Kaiserslautern (Germany). (<i>Relays Munich</i>)		318.8	941	1.5	Naples, INA (Italy). (<i>Relays Rome</i>)	
550	545	18.5	Budapest No. 1 Lakihegy (Hungary)		315.8	950	1.6	Marseilles, PTT (France)	
542	554	10	Sundsvall (Sweden). (<i>Relays Stockholm</i>)		312.8	959	0.7	Radio Vitus (Paris). (<i>S.-W. Stn. on 43.75 m.</i>)	
537.6	558	3	Palermo (Italy)		312.8	959	1.7	Cracow (Poland)	
533	563	60	Munich (Germany)		312.8	959	10	Genoa, IGE (Italy). (<i>Relays Turin</i>)	
525	571	15	Riga (Latvia)		309.9	968	50	West Regional (Washford Cross)	
517.2	580	100	Vienna (Bisamberg) (Austria)		307	977	0.75	Zagreb (Yugoslavia)	
509	589	15	Brussels No. 1, Velthem (Belgium). (<i>In French</i>)		304	986	13	Bordeaux Lafayette, PTT (France)	
500.8	599	20	Florence, IFI (Italy). (<i>Relays Turin</i>)		301.5	995	50	North National (Manchester)	
495.8	605	1.2	Trøndelag (Norway)		298.8	1004	11	Tallinn (Esthonia)	
488.6	614	120	Prague (Czechoslovakia)		296.1	1013	20	Huizen (Holland). (<i>7 kW. before 4.40 p.m.</i>)	
480	625	50	North Regional (Manchester)		293.5	1022	0.7	Limoges, PTT (France)	
472.4	635	60	Langenberg (Germany)		293.5	1022	2.6	Kosice (Czechoslovakia)	
465.8	644	1.5	Lyons la Doua, PTT (France)		291	1031	13.2	Viipuri (Viborg) (Finland). (<i>Relays Helsinki</i>)	
459.4	653	60	Beromünster (Schweizerischer Landessender) (Switzerland)		288.3	1040	50	Scottish National (Falkirk)	
					288.3	1040	1	Bournemouth. (<i>Relay Station</i>)	
453.2	662		San Sebastian, EAJ8 (0.6 kW.); Pori (1.0 kW.) (Finland); Danzig (0.5 kW.) (<i>relays Heilsberg</i>); Klagenfurt (0.5 kW.) (Austria) (<i>relays Vienna</i>); Porsgrunn (0.7 kW.) (<i>relays Oslo</i>); Tromsø (0.1 kW.); Bodø (0.5 kW.) (Norway); Uppsala (0.15 kW.) (Sweden) (<i>relays Stockholm</i>).						

BROADCASTING STATIONS ABROAD (In Order of Wavelength)

Table with columns: Metres, kc/s, kW, Station, Tuning Positions, Metres, kc/s, kW, Station, Tuning Positions. Lists various international broadcasting stations and their technical specifications.

PRINCIPAL SHORT-WAVE STATIONS

(N.B.—Times of Transmission, given in parentheses, are approximate only and represent B.S.T.)

Table with columns: Metres, kc/s, Call Sign, Station, Tuning Positions, Metres, kc/s, Call Sign, Station, Tuning Positions. Lists principal short-wave stations with call signs and transmission times.

FOREIGN SUNDAY PROGRAMMES

SEPTEMBER THE TWENTY-FOURTH

PRINCIPAL EVENTS OF THE DAY:

AT HOME

- NATIONAL** Harvest Festival service from Cranleigh Parish Church.
- LONDON REGIONAL** Guards Band concert.
- MIDLAND REGIONAL** Orchestral concert from the Winter Gardens, Droitwich Spa.
- NORTH REGIONAL** A programme of glees.
- WEST REGIONAL** A nocturne; orchestral concert.
- SCOTTISH REGIONAL** Service from St. Mungo's Church, Alloa.

ABROAD

- BRUSSELS (No. 2)** 9.0 p.m. The Symphony Orchestra, conducted by Kumps.
- BUCHAREST** 8.20 p.m. Concert by the Station Orchestra.
- BUDAPEST** 7.45 p.m. Concert of operetta music.
- COPENHAGEN** 8.5 p.m. Léhar operetta concert. 10.15 p.m., French opera music, by the Station Orchestra.
- HEILSBERG** 8.0 p.m. The Königsberg Opera House Orchestra.
- LEIPZIG** 8.0 p.m. The Symphony Orchestra.
- OSLO** 8.0 p.m. Concert by the Budapest Trio.
- PITTSBURGH** 8.0 p.m. National opera concert.
- PRAGUE** 7.0 p.m. Opera: "Libusa," by Smetana, from the National Theatre.
- TURIN** 8.30 p.m. Opera: "Ruy Blas," by Marchetti.

COPENHAGEN

1,067 kc/s, 281 metres; 0.75 kW. Relayed by Kalundborg, 250 kc/s, 1,153.8 metres.—8.0 a.m., Gymnastics for Women. 8.15, Gymnastics. 9.0 to 9.30, Talk. 10.0, Divine Service from the Cathedral. 11.30, Weather and News. 12 Noon, Time and Chimes from the Town Hall. 12.5 p.m., Concert by Louis Freil's Instrumental Ensemble. 1.30, Talk in English: The Grand Tour of Scotland. 1.50, German Lesson. 2.10, Reading in French. 2.30, Gramophone Concert. 3.0, Programme for Children. 3.30, Concert by the Radio Orchestra, conducted by Launy Gröndahl. Soloist: Edet Wamberg (Songs). 5.0 (also relayed by Skamiebaek on 31.51 metres), Divine Service, relayed from the Holmens-Kirke. 6.20, Talk. 6.50, Weather, News and Sports Results. 7.15, Time Signal. 7.30, Talk. 8.0, Chimes from the Town Hall. 8.5, Lehár Operetta Concert by the Station Orchestra, conducted by Emil Reesen: Prelude to Eva; Selection from The Czarevitch; Waltz from Der Göttergatte; Selection from Schön ist die Welt; Overture, Gipsy Love. 8.50, The Hansen Family—Sketch (Locher). 9.5, Folk Songs of the Nations by a Male Voice Chorus—Denmark, Norway, Iceland, Sweden, Finland, the Netherlands, England, Scotland, Ireland, Switzerland, Germany and Austria. In the interval, Readings. 10.5, News. 10.15, Concert of French Opera Music by the Station Orchestra, conducted by Emil Reesen: Overture, Jean de Paris (Boieldieu); Rondo from Les Deux Avoies (Grétry); Overture and Tarentella from Masaniello (Auber); Prelude to Djanielli (Bizet); Selection from Carmen (Bizet); Overture, La Princesse Jaume (Saint-Saëns); Bacchanale from Samson and Delilah (Saint-Saëns). 11.0, Dance Music, relayed from the Wivex Restaurant. In the interval at 12 Midnight, Time and Chimes from the Town Hall. 12.30 (Monday), Close Down.

CORK.—See Athlone.

DANZIG.—See Heilsberg.

DRESDEN.—See Leipzig.

FECAMP

1,328 kc/s, 225.9 metres; 10 kW.—11.0 a.m. till 12 Noon, Programme in English by the I.B.C. 11.0, Happy Hour. Part I, Orchestral Concert: Signature Tune; Classical Selection (arr. Ewing); Invitation to the Waltz (Weber); Selection from Die Fledermaus (Joh. Strauss); Anitra's Dance from the Peer Gynt Suite (Grieg); Scarf Dance (Chaminade); Ich liebe Dich (Grieg); Hungarian Dance No. 6 (Brahms); Waltz from The Sleeping Beauty (Tchaikovsky). Part II, Organ Recital: Selection from Indian Love Lyrics (Woodforde-Finden); Berceuse de Jocelyn (Godard); Les millions d'Arlequin (Drigo); Melody in F (Rubinstein); The Londonderry Air; Suite, Ballet égyptien (Luigini); Cathedral Chimes (Lindahl); Chant sans paroles (Tchaikovsky); Signature Tune. 12 Noon, Programme in French. 2.0 to 7.30 p.m., Programme in English by the I.B.C. 2.0, Variety Concert: Ah, Sweet Mystery of Life; The Song of Songs (Moya); Selection from Orpheus in the Underworld (Offenbach). 2.15, Concert for Blind Club Members: Signature Tune, The Night by the Sea; Overture, William Tell (Rossini); Rhapsody on Alice, where art thou? (Ascher); Liebestraum (Liszt); Valse brune (Krier); Melody in F (Rubinstein); Dance of the Hours (Ponchielli); Barcarolle from The Tales of Hoffman (Offenbach); Summer Days Suite (Coates). 3.0, Light Music: Selection from Music in the Air: Ding, Dong, Ding (Evans); Jealousy (Gade); I've found the right girl (Gay); The Song of the Rose (McCullough); Down in the Valley (Harrington); Animal Antics (Wark); Roll up the Carpet (Goodhart). 3.30, Light Orchestral Music: What's next? (arr. Finck); Chinatown, my Chinatown (Schwartz); Handsaw Solo, The Rosary (Nevin); Selection from Chu Chin Chow (Norton); Green Hills of Somerset (Coates); Violin Solo, Indian Love Call from Rose Marie (Primi); Old Music-Hall Memories; Last night I dreamed of you (Kallman). 4.0, Judge Rutherford's Address. 4.15, Programme for Children. 4.30, Descriptive Adventure Story. 5.0, Charles Stevens' Orchestral Concert: Southern Rhapsody (Hosmer); In a Country Lane, from the Summer Days Suite (Coates); Violin Solo, Valse bhette (Drigo); Selection from The Flower of Hawaii (Abraham); Cello Solo, Harlequinade (Squire); My Lady Dainty (Hesse); Ay, Ay, Ay (Freire); Frühlingsstimmen (Strauss). 5.30, Concert: Popular Music of To-day: Signature Tune; Jolly Good Company; A Medley of British Songs; Selection from Words and Music (Coward); Serenade (Heykens); Selection from The Cat and the Fiddle (Kern); Jack-in-the-Box (Shand); Violin Solo, The Song of Songs (Moya); Xylophone Solo, Snappy Sticks (Robblus); Selection from Congress Dances (Heymann). 6.0, Club Concert for Dumfries Listeners. Part I—Orchestral Music. Signature Tune, The Churn Song; Mrs. Ferguson of Raith's Delight; Scarf Dance (Chaminade); The Wedding of the Rose (Jessel);

ATHLONE

725 kc/s, 413 metres; 60 kW. Relayed by Cork, 1,337 kc/s, 224.4 metres.—8.30 p.m., Time Signal. 8.31, Concert by Lucy Lee-nane's Instrumental Trio. The Glasgow Orpheus Choir, conducted by Sir Hugh S. Robertson. The Mystics in a Drama, and Soprano Solos by Gertrude Mortimer. 11.0, Time Signal, News, Weather Report, and Close Down.

BARCELONA

EAJ1, 863 kc/s, 348.8 metres; 8 kW.—12 Noon, Chimes from the Cathedral and Weather. 2.0, Gramophone Music. In the interval at 2.30, Theatre Notes. 3.0, Sextet Concert. 4.0, Programme for Hospitals and other Benevolent Institutions, with Gramophone Records. 5.0 to 6.30, Interval. 6.30, Agricultural Talk in Catalan and Gramophone Music. 7.0, Concert by the Station Orchestra. 7.30, Song Recital by Pepita Paulet. 8.0, Concert by the Station Orchestra. Soloists: Paquita Gilbert (Songs) and Josefa Tomás (Pianoforte). 9.0, Dance Music relayed from The Hollywood Bar. 10.0, Musical Comedy on Gramophone Records. 11.45, Chess Lesson. 12 Midnight (approx.), Close Down.

BASLE.—See Schweizerischer Landessender.

BERLIN

DEUTSCHLANDSENDER (REICHSENDER), 183.5 kc/s, 1,635 metres; 60 kW.—6.0 a.m., Gymnastics from Berlin (Funkstunde). 6.15, News, followed by the Day's Motto, Morning Hymn and Harbour Concert from Hamburg. 8.0, Two Agricultural Talks. 8.55, Morning Recital from Nikolskos. 10.5, Weather from Berlin (Funkstunde). 11.0, Reading (Paul Ernst). 11.15, Weather. 11.30, See Leipzig. 12 Noon, See Stuttgart. 12.55 p.m., Time Signal. 1.0, Concert from Hamburg. 2.0, The German Harvest—Radio Sequence (Pätzold). 3.0, Hans Hermann Wilhelm reads from his own Works. 3.30, Song Recital by a Girls' Choir. 4.0, Reading. 4.30, Concert from Breslau. 5.30, Reading: The Philosophy of a Churl (J. Hanns Röslér). 5.50, Orchestral Concert. 6.50, Sports Notes. 7.0, Great Actors—Programme on Gramophone Records with Commentary. 8.0, Concert by the Station Orchestra, conducted by Hanns Udo Müller; Soloists, Adelheid Armhold (Soprano), Konrad Hansen (Pianoforte), and Max Bleiss (Cello). In the interval at 8.40, Radio Report of the German Cyclists' Club. 10.0, News. 10.45, Weather. 11.0, Concert from Langenberg. 12 Midnight, Close Down.

BERLIN

FUNKSTUNDE, 715 kc/s, 419.5 metres; 1.5 kW.—11.50 a.m., See Leipzig. 12 Noon, See Heilsberg. 2.0, Talks for Garden City Jewellers. 3.0, Dr. Johannes Günther speaks with Three Artists. 3.30, Concert by an Orchestra of Unemployed Musicians. In the interval at 5.10 (approx.), Running Commentary on the Second Half of the Rugby Match Hanover v. Berlin. 5.40, Siegfried Burgstaller Song Recital by Tiny Delüser (Soprano). 6.0, A Working Day in the Life of a German Peasant—a Radio Picture. 7.0, Opera Songs on Gramophone Records. 7.50, Sports Notes. 8.5, Autumn from the Seasons—Oratorio (Haydn) by the Station Orchestra, the Oratorio Society and Soloists. 8.40, Orchestral Concert, conducted by Will Hahn. 10.0, News. 10.15 (approx.), Dance Music, relayed from the Delphi-Palast. In the interval at 11.0 (approx.), A Visit to Paris (on Gramophone Records). 1.0 a.m. (Monday), Close Down.

BERNE.—See Schweizerischer Landessender.

BEROMUNSTER.—See Schweizerischer Landessender.

BODEN.—See Stockholm.

BODO.—See Oslo.

BRATISLAVA

1,076 kc/s, 279 metres; 14 kW.—12.15 p.m., Military Band Concert. 1.30, See Prague. 1.45 to 1.50, Hydrographic Report. 3.45, Variety Programme relayed from Skalica. 5.30, See Prague. 5.45, Reading. 6.0, Piano-forte Recital by Rudolf Macduzinsky. 6.30, Talk: The Work of the Slovak League. 6.45, Gramophone Music. 6.55, Talk for Housewives. 7.0 till Close Down, See Prague. 10.50 (approx.), Close Down.

BREMEN.—See Hamburg.

BRESLAU

923 kc/s, 325 metres; 60 kW. Relayed by Gleiwitz, 1,184 kc/s, 253 metres.—11.30 a.m., See Leipzig. 12 Noon, Concert by the Silesian Symphony Orchestra, conducted by Mundry. 2.0, Talk: Amateur Films. 2.20, Talk for Stamp Collectors. 2.43, Talk: Women in Early German History. 3.0, A Play for Children. 3.30, Orchestral Concert conducted by Gerhard Rielckin. In the interval at 4.30, The New Organ at Lichten-

waldau—a Radio Report, relayed from Lichtenwaldau. 6.0, Reading (Schläke). 6.25, Talk: The Victims of Mont Blanc. 6.45, Divertimento in E Flat (Mozart) by Hanns Schmack-Urbach (Violin), Rudolf Vormeng (Viola), and Fritz Binnowsky (Cello). 7.30, Weather and Sports Notes. 8.0, A German Evening—Literary and Musical Programme. In the interval at 9.0, News. 10.0, Time and News. 10.30, Dance Music from Berlin (Funkstunde). 12 Midnight, Close Down.

BRNO

878 kc/s, 342 metres; 35 kW.—5.30 p.m., Song Recital by Milada Sklenarová. 5.45, Talk: Early Slovak Poetry. 6.0, German Transmission: Song Recital with Guitar Accompaniment. 7.0 till Close Down, See Prague. 10.50 (approx.), Close Down.

BRUSSELS (No. 1)

I.N.R., 590 kc/s, 509 metres; 15 kW.—9.45 a.m., Culinary Talk. 10.0, Gramophone Records: Violin Concerto No. 5 in A (Mozart); Symphonic Study, Falstaff (Elgar). 11.0, Concert by the Small Station Orchestra, conducted by Leemans. 12 Noon, Concert by the Station Symphony Orchestra, conducted by Kumps. 1.0 p.m., Le Journal Parlé. 1.10, Concert, conducted by Pellemann, relayed from the Grand Hotel, Antwerp. In the interval at 1.30, Monologues. 5.0, Concert by the Radio Orchestra, conducted by André. 5.30, Football Results. 6.0, Gramophone Records: Concerto in E Flat (Liszt); Overture, Le Roi d'Ys (Lalo). 6.30, Song Recital by Lina Pollard: Song Cycle, Frauen-Liebe und Leben (Schumann); Barcarolle (Schubert); Der Erikönig (Schubert). 7.0, Gramophone Music: Sonata in A (Mozart-Tertis); Teccata from Symphony No. 5 (Widor). 7.15, Religious Address. 7.30, Wireless Notes and Musical Review. 8.0, Concert by the Station Symphony Orchestra, conducted by Kumps. Soloist: Henry Wagemans (Violin); Fantasia on a Walloon Theme (Théo Ysaÿe); Romantic Concerto for Violin and Orchestra (Godard); Marche Cortège (Vreuls). 8.45, Readings of Walloon Poetry. 9.0, Concert by the Radio Orchestra, conducted by Franz André. Soloist: Thomé (Tenor); Hallelujah (Youmans); Polonaise in D for Violin (Wieniawsky); Selection from Paganini (Lehár); Three Songs from The Land of Smiles (Lehár); Morocco (Marangue); Russian Dances (Bareh). 10.0, Le Journal Parlé.

BRUSSELS (No. 2)

N.I.R., 887 kc/s, 338.2 metres; 15 kW.—Programme in Flemish. 10.0 a.m., Concert

by the Small Station Orchestra, conducted by Leemans. 11.0, Gramophone Concert. 12.0 Noon, Concert, relayed from the Grand Hotel, Antwerp. 1.0 p.m., Le Journal Parlé. 1.10, Concert by the Station Symphony Orchestra, conducted by Kumps. 5.0, Dance Music, relayed from the St. Sauveur Palais de Danse. 5.30, Sports Notes. 6.15, Movements from the Quartet in A Minor (Schumann) on Gramophone Records. 6.30, Concert by the Small Station Orchestra, conducted by Leemans. 7.15, Religious Address. 7.30, Review of Music. 8.0, Concert by the Radio Orchestra, conducted by Franz André. Soloist: Mme. Marie-Rose (Soprano); Overture, The Bohemian Girl (Bulfe); Three Pieces (Fletcher); Finale from the Violin Concerto in E (Vieuxtemps); Songs; Romanian Airs (Dauber); Melody (Offenbach); Fantasia appassionata for Pianoforte (Saint-Saëns); At the Circus (Armandola). 8.45, Reading Egypt (Römer). 9.0, Concert by the Symphony Orchestra, conducted by Kumps. Soloist: Henry Wagemans (Violin); Overture, Euryanthe (Weber); Caprice for Violin and Orchestra (Güiraud); Three Romantic Waltzes (Chabrier); Gipsy Suite (Wormser); Feestklanken (Verheyden). 10.0, Le Journal Parlé.

BUCHAREST

761 kc/s, 394 metres; 12 kW.—5.0 p.m., Dance Music by the Seidmann Jazz Band. In an interval at 6.0, Radio Journal. 7.0, Educational Talk. 7.20, Gramophone Music. 7.40, Talk. 8.0, Song Recital by Gabriel Popescu. 8.20, Concert by the Station Orchestra: Overture, The Bohemian Girl (Bulfe); The Nut-Cracker Suite (Tchaikovsky); Elegy (Ernst); Selection from The Flower of Hawaii (Abraham); Spanish Dance (Falla). In an interval at 9.0, Talk. 9.45, Radio Journal.

BUDAPEST

545 kc/s, 550.5 metres; 18.5 kW.—Also relayed on 840 metres from 7.45 p.m. till 12 Midnight. 9.15 a.m., News. 10.0, Divine Service. 11.0, Catholic Service from a Church. 12.30 (approx.), Concert by the Opera House Orchestra, conducted by Otto Berg. 2.0, Gramophone Music. 3.45, Talk. 4.30, Military Band Concert. 5.30, Reading. 6.0, Concert by Eugen Farka's Gypsy Band. 7.15, Talk. 7.45, Concert of Operetta Music by the Budapest Concert Orchestra, conducted by Fridl; Soloists: Gabrielle Belle and Johann Halmos. 9.30, Piano-forte Recital. 10.15, Concert from the Café Ostende; Soloist, Paul Kalmar in his Repertoire. 12 Midnight, Close Down.

CASSEL.—See Frankfurt.

SEPT. 24th **SUNDAY** continued

Agricultural Talk. 12.45 p.m., Giornale Radio. 1.0 to 2.0, Concert of Light Music. In the interval at 1.30, Time, Announcements and Weather. 5.20 to 6.30, Gramophone Music. 8.0, Dopolavoro Announcements and Giornale Radio. 8.20, Sports Notes. 8.25, Gramophone Music. In the interval at 8.30, Time and Announcements. 8.45, Orchestral Concert, conducted by La Rosa Parodi. In the interval, Talk. After the Concert, Gramophone Music. 11.0 (approx.), Close Down.

PARIS

EIFFEL TOWER, Call FLE, 207.5 kc/s, 1,445.7 metres; 13 kW. Time Signals (on 2,650 metres) at 10.26 a.m. and 11.26 p.m. (Preliminary and 6-dot Signals)—1.0 p.m., News. 1.15, Weather. 1.30 to 2.30, Concert by the Ilios Orchestra. 6.45, Le Journal Parlé. 8.30, Gramophone Concert: Part 1: Italian Music; Part 11: Variety Music. 10.0 (approx.), Close Down.

PARIS

POSTE PARISIEN, 914 kc/s, 328.2 metres; 60 kW.—10.0 a.m., Gramophone Music. 10.20, Press Review. 10.30, Sponsored Concert. 11.0, Orchestral Concert. 12.15 p.m., Sponsored Concert of Sound Film Music. 12.45, Sponsored Programme. 12.50, Half an Hour of Fantasy by Paul Weill. 1.30, Sponsored Programme. 2.0, Interval. 7.0, Le Journal Parlé. 7.5, Sports Notes. 7.15, Gramophone Music. 7.30, Catholic Review. 8.0, Classical Music on Gramophone Records. 8.30, Sponsored Concert. 9.15, Literary Programme. 9.54, Concert. 10.15, News.

PARIS

RADIO-PARIS, 174 kc/s, 1,725 metres; 75 kW.—7.45 a.m., Gramophone Music. 8.0, Press Review and Weather. 8.30, Physical Culture. 12.0 Noon, Religious Address. 12.20 p.m., Sacred Music: Prelude in E Minor (Bach); Pastoral (Pachelbel); In dulce júbilo (Buxtehude). 12.30, Gramophone Concert. 1.30 to 3.0, Programme in English by the I.B.C. 1.30, Gramophone Concert: L'Heure douce (Esclavy); Selection from Liliac Time (Schnbert-Berté); Song from Les noces de Jeannette (Massé); Sérénade badine (Gabriel Marie); Arlequin (Lalo); Concert Polonaise (Vidal). 2.0, Concert of Dance Music: Signature Tune, Happy Feet; From me to you; Just making conversation; Learn to croon; If I had somebody to love; Roll up the Carpet; Moonstruck; Sundown in a little green hollow; It's a nice day to-day; Signature Tune. 2.30, Orchestral Concert: March, Stars and Stripes (Souza);

Dixieland (Stoddon); Barcarolle from The Tales of Hoffmann (Offenbach); Selection from The Gipsy Princess (Kálmán); Selection from Bitter Sweet (Coward). 3.0, Variety Music. 5.30, Gramophone Music: Au moulin (Gillet); La valse bleue (Nargis); Chant d'après-midi (Cuvillier); La Mousmée (Ganne); Honolulu (Yvain); Sous les ponts de Paris (Scott); Selection from Scaramouche (Messenger-Yatove); March des petits pierrots (Bosc). 6.0, Popular Concert. 7.0, Variety Music. 8.0, Gramophone Music. 8.30, News, Sports Notes and Weather. 8.45, Gramophone Music (contd.). In the interval at 9.15, Press Review and News.

PITTSBURGH

KDKA, 980 kc/s, 306 metres; 50 kW. Relayed by W8XK on 48.86 metres and 25.27 metres.—5.30 to 6.30 p.m., Radio City Concert, from New York. 7.0, Boys of Wynecastle. 7.15 to 11.0, New York Relay. 7.15, Summer Idylls. 7.30, Popular Programme. 8.0, National Opera Concert. 9.0, Gould and Sheffer. 9.15, Ennio Bolognini. 9.30, Organ Recital. 10.0, Vesper Services. 11.0, News, Among Masters. 11.15, Weather, Sports. 11.30, Huston Ray's Orchestra. 12 Midnight, Variety Programme. 12.30 to 2.45 a.m. (Sunday), New York Relay. 12.30, Desert Guns. 1.0, Light Opera Nights. 2.0, Gulf Headliners. 2.30, Walter Winchell. 2.45, Programme to be announced. 3.0, Mountain Music, from New York.

PORSGRUND.—See Oslo.

PRAGUE

614 kc/s, 488.6 metres; 120 kW.—11.0 a.m., Orchestral Concert of Czech Music. Conductor: Utakar Jeremias. Soloist: Ada Nordenova (Soprano). 12 Noon, Chimes. 12.5 p.m., News. 12.15, See Bratislava. 1.30, Agricultural Talk. 1.45 to 1.55, Announcements. 3.45, See Bratislava. 5.30, A Blind Actor's Reminiscences. 5.45, Gramophone Music. 6.0, German Transmission: Programme Review. An Operetta in One Act (Pisurowitz), with the Station Orchestra, conducted by the Composer. News. 6.55, Talk on the following Transmission. 7.0, Libusa—Opera (Smetana), relayed from the National Theatre. 10.30, News. 10.50 (approx.), Close Down.

RADIO-SUISSE ROMANDE

SOTTENS, 743 kc/s, 403 metres; 25 kW.; and **Cereva, 395 kc/s, 760 metres.—9.15 a.m.** (from Aigle), Radio Report of the Walking Tour round Lake Geneva. 10.0 (from Lausanne), Protestant Service. 10.45 (from Lugano), Radio Report of the International Motor Car Race at Mont Ceneri. 12 Noon (from Vevey), Radio Report of the Walking Tour. 12.30 p.m., News and Weather. 12.40 (from Lausanne), Gramophone Concert. 2.0 (from Lausanne), Sports Relay from the Stadium. Walking Tours, Rugby and Football Matches. 5.30, Interval. 7.0, Religious Address. 7.40, Sports Notes. 8.0, Concert by the Radio-Suisse Romande Orchestra. Soloist: Henri Honegger (Cello). Selection from Il Seraglio (Mozart); The Unfinished Symphony (Schubert); Cello Concerto (Lalo); Overture, Penelope (Faure); Petite Suite (Debussy). 9.0 (from Lausanne), Readings. 9.15 (from Lausanne), Cello Recital by André Levy; Sonata in B Flat (Händel); Suite in C (Boccherini); Spanish Dance (Fallá); Tarantella (Casella); Two Pieces (Ibert). 9.50, News. 10.0 (from Lausanne), Pianoforte Recital by Irene Hertzog; Sonata in D (Mozart); Prelude (Prokofiev); Jugend Erinnerung (Iseerlis); Tarantella (Blanchet); The Blue Danube (Strauss-Schultz-Evler). 10.50 (approx.), Close Down.

RJUKAN.—See Oslo.

ROME

Call 1RO, 680 kc/s, 441 metres; 50 kW. Relayed by 2RO, 11,810 kc/s, 25.4 metres, from 5.15 p.m.; Bari, 1,112 kc/s, 239.8 metres; Milan (Vigentino), 662 kc/s, 453.2 metres, from 8.45 p.m.; and Naples, 941 kc/s, 319 metres.—10.0 a.m., News, Sports Notes and Amusement Guide. 10.30, Agricultural Notes. 10.45, Bible Reading. 11.0, See Turin. 2.0, Time and Announcements. 5.0 (from Naples), Programme for Children. Weather, and Sports Notes. 5.15 to 6.30, Vocal and Instrumental Concert. In the interval at 5.30, Sports Notes. 6.30, Weather. 7.30, Sports Notes, Popolovano Report and News. 7.45, Mezzo-Soprano Solos by Bianca Bianchi. 8.0, Time and Announcements. 8.30, Sports Notes. 8.45, Variety Concert: Ornella Piliti-Santoliquido (Pianoforte). Maria Senes (Soprano) and Emilio Livi (Tenor); Pianoforte Solos; (a) Capriccio (Dohnanyi), (b)

Per una vecchia beona (Rocca), (c) Per un guerriero (Rocca); Gramophone Records: (a) Suite, The Good-humoured Ladies (Scarlatti-Tommasini). (b) Waltz Intermezzo (R. Strauss), (c) Second Entr'acte from The Jewels of the Madonna (Wolf-Ferrari), (d) Dance of the Tumblers from The Snow Maiden (Rimsky-Korsakov); Soprano Solos: (a) Two Arias from Figaro (Mozart), (b) Maria Wiegand (Reger), (c) Douce estas corazon (Sorrano); Tenor Solos: (a) Almaviva's Serenade from The Barber of Seville (Rossini), (b) Arias from Rigoletto (Verdi); Questa o quella and La donna è mobile, (c) Aria from Marsha (Plotow). (d) Princesita (Padilla); Dance Music. 11.0, News.

SALZBURG.—See Vienna.

SCHENECTADY

WGV, 790 kc/s, 379.5 metres; 50 kW. Relayed at intervals by W2XAF on 31.48 metres, and by W2XAD on 19.56 metres.—8.0 to 10.0 (approx.), New York Relay. 8.0 p.m., Gene Arnold and the Comodoros. 8.15, Pop. concert. 9.0, Wayne King's Orchestra. 9.30 to 10.0, Radio Pulpit. 1.45 to 4.45 a.m. (Monday), New York Relay. 1.45, Popular Programme. 2.0, Variety Programme. 3.0, Manhattan Merry-Go-Round. 3.30, American Album of Familiar Music. 4.0, Musical Programme. 4.15, Impressions of Italy. 4.45, Sunday at Seth Parker's, from New York, followed by Programme Resumé.

SCHWEIZERISCHER

LANDESENDER

BEROMUNSTER, 653 kc/s, 459 metres; 60 kW.; **Basle, 1,229 kc/s, 244.1 metres;** and **Berne, 1,220 kc/s, 245.9 metres.—10.0 a.m.** (from Zürich), Protestant Service. 10.45, See Radio-Suisse Romande (Sottens). 12.0 Noon (approx.) (from Zürich), Gramophone Concert. 12.30 p.m., Time, Weather, and News. 12.40 (from Zürich), Concert by the Station Orchestra, conducted by Neppach. 1.30 (from Zürich), Agricultural Programme. 2.30 to 5.0, Interval. 5.0 (from Zürich), Gramophone Concert. 5.30 (from Zürich), Talk: The Care of the Aged. 6.0 (from Zürich), Talk: Ping-pong, etc. 6.30 (from Zürich), Readings. 7.0 (from Zürich), Sports Results. 7.10 (from Zürich), Organ Recital by Peter Stüssi. 8.0 (from Zürich), Songs in Dialect. 9.0, News. 9.10 (from Zürich), Dance Music. 10.15 (from Zürich), Sports Notes.

SOTTENS.—See Radio-Suisse Romande.

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SEPT. 24th

SUNDAY

continued

STOCKHOLM

689 kc/s, 436 metres; 55 kW. Relayed by Boden, 244 kc/s, 1,229.5 metres; Göteborg, 932 kc/s, 322 metres; Morby, 1,166 kc/s, 257 metres; Motala, 221.5 kc/s, 1,354.4 metres; Östersund, 389 kc/s, 770 metres; and Sundsvall, 554 kc/s, 542 metres.—9.0 a.m., Rural Programme. 9.30, Gramophone Music. 10.10, Talk for Workers. 11.0 (from Göteborg), Divine Service. 12.45 p.m., Weather. 3.0, Provincial Programme. 3.30, Reading. 4.0, Gramophone Music. 5.5, Programme for Children. 5.30, Pianoforte Recital by Mary Barratt-Due. 6.0, Divine Service. 7.15, Weather and News. 7.35, Master Olof—Play (August Strindberg). 9.15, Concert by the Station Orchestra; Soloist, Stefan Frenkel (Violin). In the interval at 9.45, Weather and News. 11.0 (approx.), Close Down.

STRASBOURG

869 kc/s, 345 metres; 11.5 kW.—9.30 a.m., Orchestral Concert, conducted by Maurice de Villers. 10.45, Protestant Service in German. 11.30, Catholic Service. 12 Noon, Classical Music on Gramophone Records. 12.45 p.m., News. 1.0, Time. 1.1, Light Music on Gramophone Records. 2.0, Popular Music on Gramophone Records. 3.0, Interval. 4.0, Chamber Music, relayed from Radio Coloniale (Paris), 15,243 kc/s, 19.68 metres. 5.0, Orchestral Concert, conducted by Roskam: March, Saint à l'Alsace (Sali); Waltz, Wood Violets (Petras); Waltz from The Nuremberg Doll (Adam); Three Melodies (Brahms); Liszt Potpourri (Glazunov); Selection from La Bohème (Puccini); Orchestra Suite, Mascarade (Lacôme). 6.0, Medical Talk in German. 6.15, Sports Talk. 6.30, Orchestral Concert, conducted by Maurice de Villers: Overture, Le Caid (Thomas); Selection from La pâtisserie de la Reine Pédouque (Levadé); Suite from The Sleeping Beauty (Tchaikovsky); Ballet Music from Lakmé (Delibes); March, Pomp and Circumstance (Elgar). 7.30, Time and News. 7.45, Gramophone Music. 8.0, Press Review in German. Lottery Results and Announcements. 8.30, Dramatic Programme: (a) Les Jolies amoureuses—Play in Three Acts in Verse (Marivaux). 9.30 (approx.), Press Review. 10.30, Dance Music, relayed from the Savoy. 12 Midnight (approx.), Close Down.

STUTTGART

MUHLACKER, 832 kc/s, 360.5 metres; 60 kW. Relayed by Freiburg, 527 kc/s, 570 metres.—11.30 a.m., See Leipzig. 12 Noon, Orchestral Concert relayed from Glotterbad. 1.0 p.m., Topical Talk. 1.15, Aureliano Pertile Song Recital on Gramophone Records. 1.30, The Jupiter Symphony in C, No. 41 (Mozart), on Gramophone Records. 2.0, Agricultural Talks. 2.30, Songs of the Nations by Gna Comert. 3.0, Choral Concert. 3.30, Tempo-Tempo—Play for Children (Eise Holle-Hellmund), with Music by Gustav Görlich. 4.30 (from Mannheim), Concert by the Philharmonic Orchestra, conducted by Ludwig Becker. 5.30, Reading of a Swabian Story (Gaupp). 6.0, Pianoforte Sonata in F minor, Op. 57—the Appassionata (Beethoven) by Hans Brehme. 6.30, Sports Report. 6.50, A Swabian Musical Instrument—Radio Picture relayed from Trossingen. 7.20, Nazi Band Concert. 8.0, See Frankfurt. 10.20, Time and News. 10.45, Dance Music relayed from Berlin (Funkstunde). 12 Midnight, Close Down.

SUNDSVALL.—See Stockholm.

TOULOUSE

RADIOPHONIE DU MIDI, 779 kc/s, 385 metres; 8 kW.—11.0 a.m., Dance Music. 11.30, Military Music. 11.45, Music from Sound Films. 12 Noon, Organ Solos. 12.15 p.m., Operetta Music. 12.30, Viennese Music. 12.45, Accordion Music. 1.0, Amusement Guide. 1.5, Opera Music. Bacchanal from Tannhäuser (Wagner); Triumphant March from Aida (Verdi). 1.15, Chansonnettes. 1.30, Orchestral Music. 1.45, Opera Music. Duet from Act I of Manon (Massenet); Air from Mirella (Gounod); Clair de lune from Werther (Massenet); Air from Fortunio (Messager). 2.0, Orchestral Music. 2.30, Popular Melodies. 2.45, Agricultural Notes. 3.0, Lakmé—Opera (Delibes) (Concert Version). 4.15, Military Music. 4.30, Music from Sound Films. 4.45, Music by an Argentine Orchestra. 5.0, Dance Music. 5.45, Accordion Music. 6.0, News. 6.15, Popular Melodies. 6.30, Opera Music. Ballad from L'Africaine (Meyerbeer); Air from William Tell (Rossini); Prelude to Faust (Gounod). 6.45, Overture, Le roi d'Ys (Lalo), by a Symphony Orchestra. 7.0, Chansonnettes. 7.15, News. 7.30, Operetta Music. 7.45, Opera Music. 8.0, Songs. 8.15, Military Music. 8.30, Opera Music. 8.45, Accordion Music. 9.0, Concerto No. 5 in A (Mozart), followed by Songs from Sound Film and Orchestral Music. 10.0, Chansonnettes. 10.15, News. 10.30, Concert for Listeners in Morocco. Ballet Music from Les deux pigeons (Messager); The Death of Siegfried and Air from The Dusk of the Gods (Wagner); The Emperor Waltz

(Job. Strauss); La Rigolomanie (Piccolini); Encore une Java (Maye). 11.0, Music by a Viennese Orchestra. 11.30, Orchestral Music. 11.45, Military Music. 12 Midnight, News. 12.5 a.m. (Monday), Dance Music. 12.30 (approx.), Close Down.

TRIESTE

1,211 kc/s, 247.7 metres; 10 kW.—9.40 to 9.55 a.m., See Turin. 9.55, Mass from the Cathedral of San Giusto. 11.0, Religious Address. 11.20, Agricultural Talk. 12 Noon till Close Down. See Turin.

TRONDHEIM.—See Oslo.

TURIN

273.7 metres; 7 kW. Relayed by Milan, 331.5 metres, Cenoa, 312.8 metres, and Florence, 509.6 metres.—9.40 to 9.55 a.m., News. 10.40, Agricultural Talk. 11.0, Mass from the Church of the Annunciation. Florence. 12 Noon, Bible Reading. 12.30 p.m., Gramophone Music. In the interval at 1.0, Time and Announcements. 1.30 (approx.) to 2.0, Orchestral Concert. 1.45 to 2.0, Gramophone Music. 4.30, Concert. In the intervals, Sports Notes and Football Results. 6.15, Weather and Gramophone Music. 6.30, Sports Notes, Football Results and Announcements. 7.0, Time and Dopplaxoro Notes. 7.10, Gramophone Music. 8.0, Announcements, News, and Sports Notes. 8.20, Talk on the following Transmission. 8.30, Ruy Blas—Opera (Marchetti). In the intervals, Talk and Theatre Notes. After the Opera, Giornale Radio.

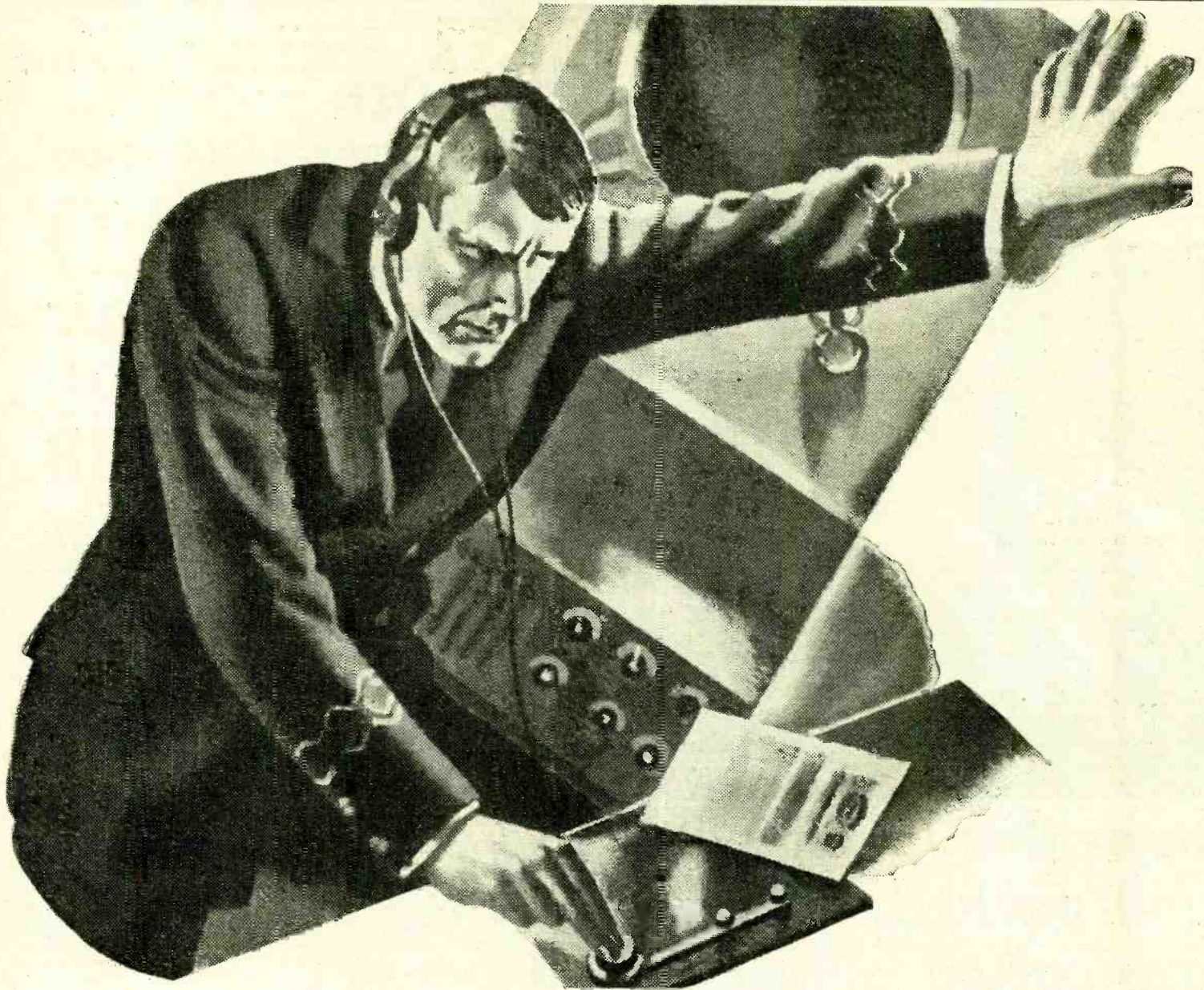
VIENNA

581 kc/s, 517 metres; 100 kW. Relayed by Graz, 852 kc/s, 352.1 metres; Innsbruck, 1,058 kc/s, 283 metres; Klagenfurt, 662 kc/s, 453.2 metres; Linz, 1,220 kc/s, 245.9 metres; and Salzburg, 1,373 kc/s, 219.5 metres.—11.30 a.m., Radio Report of the International Hill Climbing Races on the Semmering. 11.50, Reading (Max Hayek). 12.5 p.m., Concert by the Vienna Chamber Orchestra, conducted by Karl Audereth. Soloist: Karl Baltz (Violin). Glee (Teleman). Violin Concerto in A minor (Spohr); Suite for Strings (Janacek); Violin Pieces: Fantasia on Two Russian Folk Songs, Karaminskaya (Glinka); Serenade, Op. 15 (Fiedler); Overture to a Comedy (Reznicek). In the intervals, Relay of the International Hill Climbing Race on the Semmering. 2.40, Time and Announcements. 3.0, Agricultural Talk. 3.20, Book Review: Reminiscences of Pre-War Austria. 3.45, Concert by the Anita Ast Quartet: String Quartet in A (Bittner); String Quartet in F minor, Op. 95 (Beethoven). 4.45, Talk: The Mighty Danube. 5.30, Concert by the Wiener Symphoniker, conducted by Josef Holzer. 6.30, Recital of Arias and Ballads by Franz Höhling (Bartone); Archibald Douglas (Löwe); Aria from Figaro (Mozart); Bileorff (Wolf); Gerard's Monologue from Andrea Chénier (Giordano); Bolero from Don Quixotte (Kienzl); Nilakantia's Aria from Lakmé (Delibes); The Two Grenadiers (Schumann); Hans Sachs' Monologue from the Mastersingers (Wagner). 7.20, Bruno Wolfgang reads from his own works. 7.50, Time and Announcements. 8.0, Minna von Barnhelm—Comedy in Five Acts (Lessing). 10.0, Announcements. 10.15, Military Band Concert. After the Concert, Announcements.

WARSAW

212.5 kc/s, 1,411 metres; 120 kW.—10.50 a.m., Programme Announcements. 11.0, Divine Service and Unveiling of the War Memorial to the Fallen of the Seventh Legionary Regiment, relayed from Chelm Lubelski. In an interval at 11.57, Time Signal, and Fanfare from St. Mary's Church, Cracow. 12.50 p.m., Weather Report. 12.55, Concert by the Station Orchestra conducted by Oziminski. Soloist Mlle. Perenson (Soprano). 2.0, Agricultural Programme and Weather Report. 2.20, Choral Music. 2.45, Talk on the Corn Trade. In the interval, News. 4.0, Topical Talk. 4.15, Talk on Denmark. 4.30, Gramophone Music. 5.0, Talk. 5.15, Polish Dance Music by the Adam Stromberg Orchestra. 6.0, Song Recital by Wronski. Aria from The Haunted Castle (Moniuszko); Aria from Martha (Flotow); Aria from the First Act of Don Pasquale (Donizetti); Aria from the Third Act of André Chénier (Giordano); Don Juan's Serenade (Tchaikovsky); Two songs (Buzzi-Peccoli): (a) Non una ferita. (b) Nina Querida. 6.35, Programme Announcements. 6.40, Miscellaneous Items. 7.0, Talk. 7.40, Answers to Technical Correspondence. 8.0, Szymanowski Concert for the Composer's Fiftieth Birthday. The Station Orchestra, conducted by Fiteberg. Soloists: Szymanowski (Pianoforte), Korwin-Szymanowski (Songs) and Umńska (Violin). Introductory Talk by Prof. Z. Jachimecki, relayed from Cracow, 959 kc/s, 312.8 metres. In the interval, Radio Journal. 10.0, Sports Talk. 10.15, Aviation Weather Report and Police Notes. 10.20, Programme relayed from Lwow, 788 kc/s, 381 metres.

ZURICH.—See Schweizerischer Landessender.



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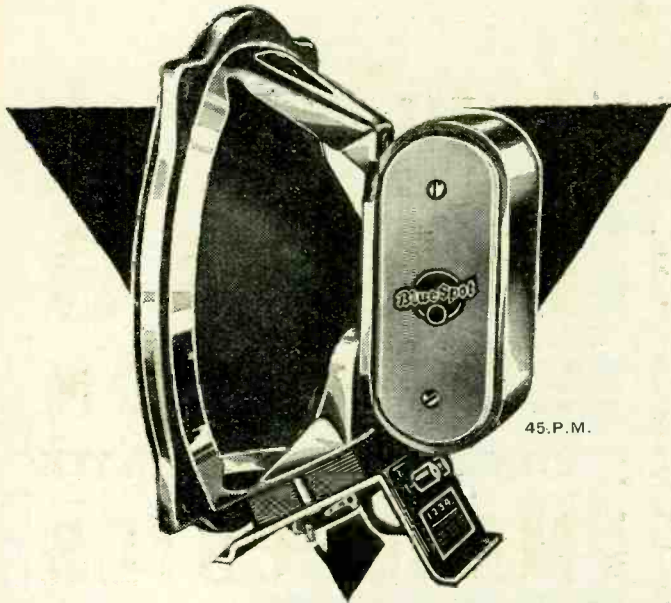
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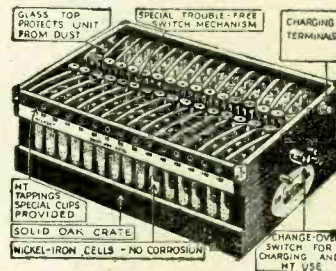
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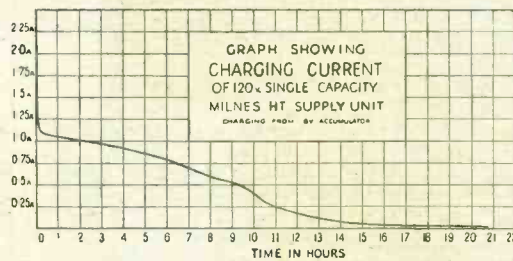


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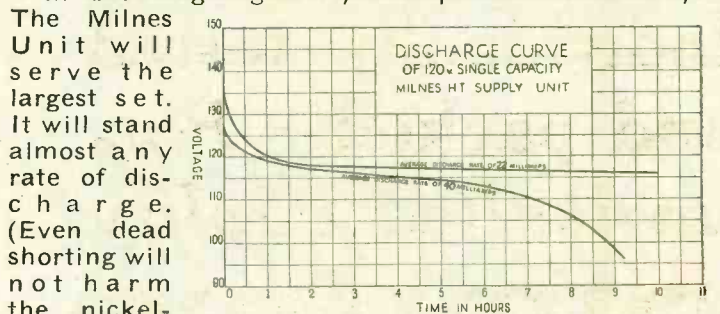


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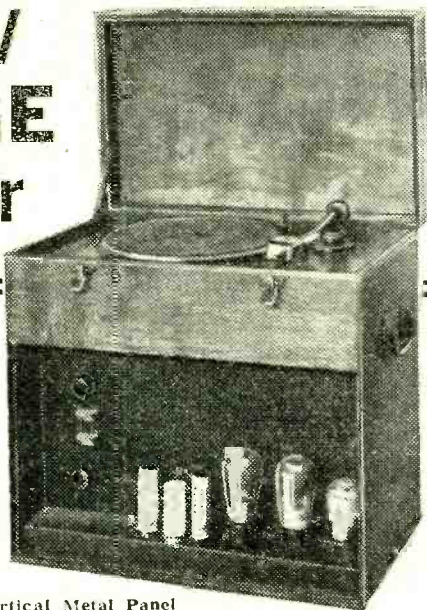
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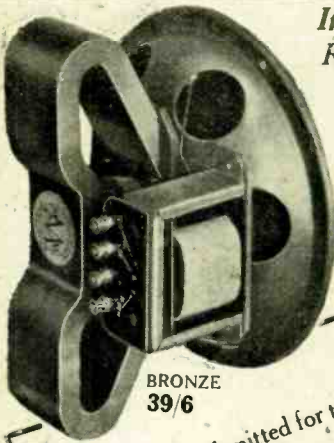


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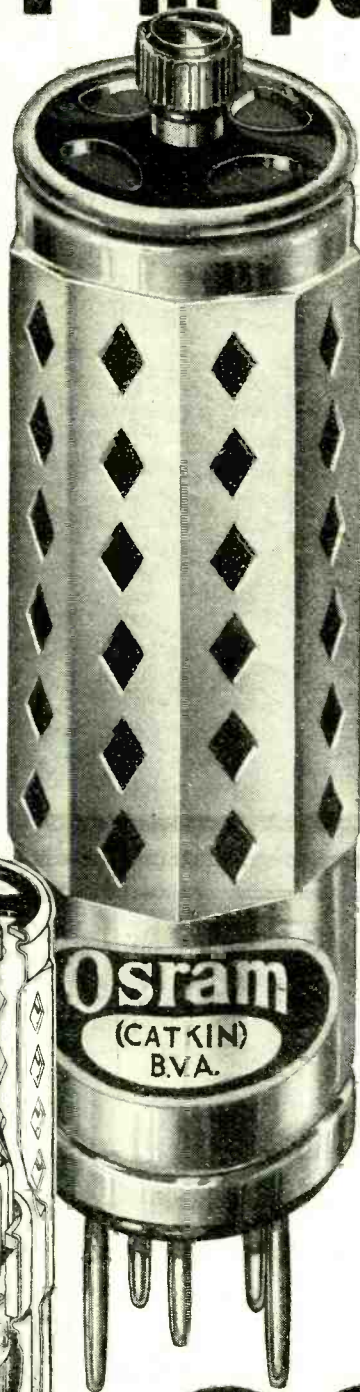
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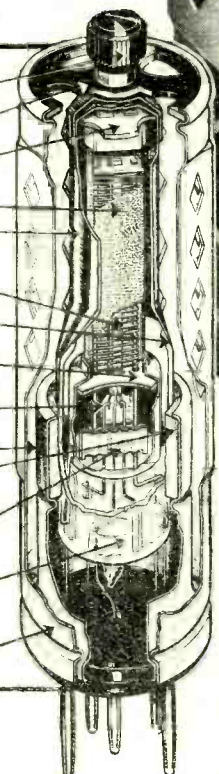
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23rd Year of Publication

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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EDITORIAL COMMENT

Car Radio

The Rumours of Official Restrictions

INTEREST in car radio is undoubtedly increasing in this country and it looks as if, in the course of the next few months, a large number of sets will be fitted both on new models of cars and existing types. All sorts of rumours have been current as to what may be the official attitude towards car radio, and it has been suggested that the Ministry of Transport or the Home Secretary will prohibit the use of wireless whilst cars are travelling on the road.

It is not unnatural that some alarm should be felt by those wireless manufacturers who are at present interesting themselves in the development of car radio at the idea of restrictions of this kind, because the public are not likely to spend money if there is any likelihood of a ban being put on the use of the sets at an early date.

Wireless on motor cars is not by any means a new idea; portable sets have been carried for years past, and sets built in as permanent fittings on a car have also been known in this country almost since the days that broadcasting started. It is only recently, however, that the possibilities of a really compact and efficient set have made the idea generally attractive for privately owned cars.

The officials of the Ministry of Transport and the Home Office have, naturally, had to look into the question of car radio from the point of view of accident risks on the road, and consider whether special regulations ought to be issued governing the use of car wireless. Consultations have certainly taken place, but, as yet, no statement has been made by these authorities

as to what their attitude will be. On the face of it, the possibility of a prohibition of wireless on cars seems impossible. It is at present not illegal to carry and use wireless on a car, and the only action that the police might take would be on the grounds that, because the driver's attention was distracted by wireless, the car was being driven negligently or dangerously. We hope that if the Home Office and the Ministry of Transport have any recommendations to put forward, or if they contemplate regulations affecting the use of wireless on cars, they will lose no time in making these known. It would be unfortunate if car radio were developed on lines which subsequently had to be revised because of new regulations.

Regulations, if any, should be with the object of ensuring simple control of the set so as to cause the least possible distraction from the attention of the driver. For this reason it seems particularly desirable that tuning should be by touch rather than visual in order to avoid any necessity for the driver to take his eye off the road in order to adjust the set.

End of Summer Time

Prepare for Winter Reception

SUMMER TIME ends in the first week of October and the change will revive intense interest in foreign station reception. Let us make the most of our opportunity now during fine weather to overhaul aerials and earths and put up the best outside aerial which space will permit. With automatic volume control there are now dozens of foreign stations which can be received as well and consistently as many locals. A good aerial will make the average set a super set from the point of view of distant reception.

Delayed Amplified A.V.C.

Designing the System—Some Practical Considerations

By W. T. COCKING

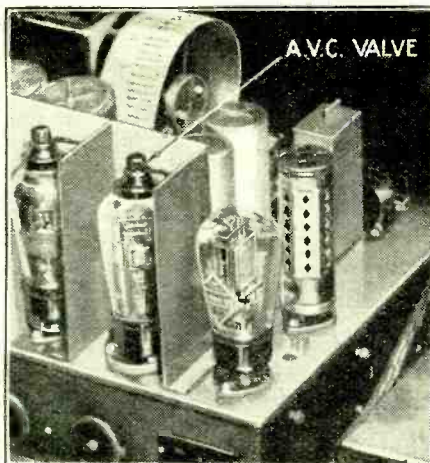
A SIMPLE method of selecting the correct delay voltage for a delayed diode automatic volume control circuit was recently described¹ and it is intended in the present article to extend the treatment to cover the case of delayed amplified A.V.C., for this is a system which better fits the average receiver in which a moderate degree of H.F. amplification and a fairly large amount of L.F. amplification are employed. With amplified A.V.C., the bias voltages developed by the detector are amplified before being applied to the H.F. valves, and this results in the detector being operated at a smaller input than in the simpler case.

The first step in design is to calculate the delay voltage required, and as before, we shall assume that two H.F. stages with Mullard V.P.₄ variable-mu H.F. pentodes are used, and that for a signal input varying in the ratio of 5,000-1 the L.F. output must not change by more than 2-1, or 6 DB. The input ratio is equivalent to a change of 74 DB, so that the amplification of the H.F. stages must change by $74 - 6 = 68$ DB between a weak and a strong signal. The bias voltage change on the H.F. valves for this can be read off from the curve B of Fig. 2, which is repeated from the previous article. Curve A of this figure shows the variation of amplification, with bias voltage for a single H.F. stage, and curve B for two such stages.

The Action of the Circuit

We see immediately that if the initial bias of 1.5 volts remains constant we require 16 volts A.V.C. bias for a strong signal, but that if the initial bias drops with increasing A.V.C. bias, as with cathode type biasing, we require nearly 17.5 volts. In the previous article we assumed that the initial bias was maintained, as when it is derived from a potentiometer across the H.T. supply; this time let us assume that cathode biasing is used, and we shall then need 17.5 volts A.V.C. bias for a strong signal.

Fig. 1 shows the fundamental circuit of the amplified A.V.C. system using transformer coupling to the succeeding valve.



A duo-diode-triode provides amplified A.V.C. in the R.G.D. Superheterodyne.

A duo-diode-triode type valve is used to provide signal rectification, delayed amplified A.V.C., and the first stage of L.F. amplification. Signal rectification occurs in the diode circuit A₁, and the D.C. potential consequent upon rectification is developed across the load resistance R₁; the L.F. voltages also appear across this resistance, and these are applied to the grid of the triode portion of the valve through the condenser C₁, the resistance

R₁ acting as a manual volume control. The full D.C. potential across R₁, however, is applied to the grid through the resistance R₂.

In the absence of a signal, the grid of the triode assumes a potential which is about 0.7 volt negative with respect to the cathode in the case of the MHD₄ valve, owing to the triode grid current

anode A₂ is returned to the earth line through R₅, the anode A₂ is negative with respect to the cathode, and there is no current flow. The bias on the H.F. valves is then only that provided by their own individual biasing resistances.

The Delay Operation

When a signal is applied to the diode A₁, rectification occurs, and the diode anode, and consequently the triode grid both assume a potential negative with respect to the cathode, and of a value which is dependent upon the signal strength. As a result, the anode current of the triode falls, and the voltage drop across R₄ is reduced. The cathode, therefore, becomes less positive with respect to the earth line. In the diode A₂ circuit nothing happens until the cathode becomes negative with respect to the earth line; when the signal is strong enough for this to occur the anode A₂ becomes positive with respect to the cathode, and this diode becomes conductive. Since the internal resistance of the diode is low compared with R₅, the internal voltage drop can be ignored, and the diode anode assumes practically the same D.C. potential as the cathode. As the cathode moves increasingly negative with respect to the earth

AMPLIFIED A.V.C. has the advantage over simpler forms in that it operates with a modest detector input and so throws less strain on the H.F. amplifier. In this article, the design of amplified A.V.C. circuits is considered in a practical manner.

flow, and the steady anode current of the triode is then determined by the value of the resistances R₃ and R₄ and by the H.T. voltage applied. Normally the circuit values are selected so that with no signal the cathode is positive with respect to the earth line by the amount of the delay voltage required. The grids of the controlled valves are returned to earth through the filter resistance R₀ and the delay-diode load resistance R₅, which normally has a value of some 0.5 meg. Since the cathode is positive with respect to the earth line, and the diode

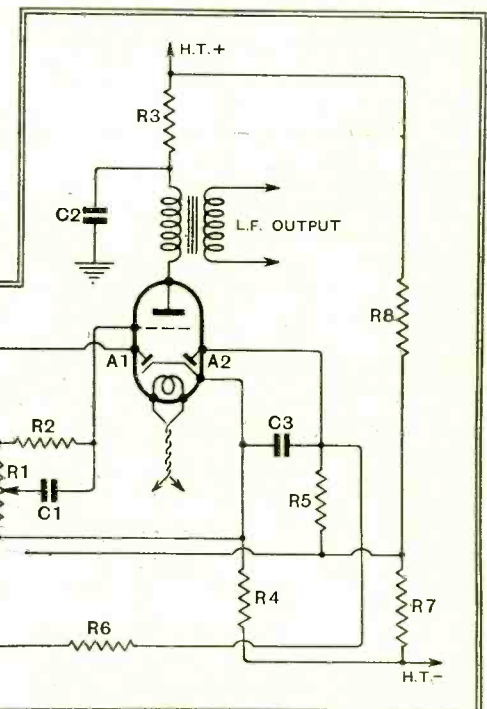


Fig. 1.—The duo-diode-triode can be connected to give delayed amplified A.V.C. The anode A₂ is negatively biased in the absence of a signal and is non-conductive. With a strong signal the anode-cathode path becomes conductive and the anode assumes practically the same potential as the cathode.

line with increasing signal strength, therefore, so the potential of the diode anode A₂ and the A.V.C. line follow it.

To return to the design problem, it will

¹ The Wireless World, Sept. 8th, 1933.

Delayed Amplified A.V.C.—

be seen that our first problem is to assign circuit values such that with no applied signal the cathode potential is positive with respect to the earth line by the delay voltage required, in this case 17.5 volts. Let us assume that we have a total H.T. supply of 270 volts, and that we need a total of 200 volts for the H.F. stages. The drop across R8 will be 200 volts (in practice this resistance may be replaced by the other valves in the set) and that across R7 will be 70 volts. The cathodes of the

former primary has zero D.C. resistance, which is untrue. The actual value used for R3, therefore, should be the calculated figure less the resistance of the transformer primary. One well-known transformer has a primary resistance of 2,400 ohms, and in this case the actual value of R3 would become 8,000 ohms.

The next step is to draw a load line on the valve curves with a slope corresponding to the total anode and cathode resistance, and from the full H.T. point of 270 volts. The total resistance is 28,650

ohms, and is represented by the line AB of Fig. 3. This permits the anode current of the valve for any grid potential to be read off, and by multiplying the current by the cathode resistance R4 we can obtain the voltage drop across this for any grid potential. This is shown by the curve of Fig. 4, and represents the cathode potential with respect to negative H.T. We are interested, however, in the cathode potential only during that time when it is negative with respect to the earth line, for

the rectification efficiency of a diode show that this D.C. potential is developed when the H.F. input is about 3 volts R.M.S., or 4.2 volts peak. It is immediately obvious that no type of variable- μ valve at any high bias would give distortion on such a small output, even when the peak value is 7.56 volts as with deep modulation. Even with a band-pass coupling preceding the detector, the output of the last H.F. or I.F. valve will only be about 15-16 volts peak, and this should raise little difficulty. The stage immediately preceding the detector can thus be fully controlled.

The L.F. voltage developed across the diode load R1 for 80 per cent. modulation will be $3 \times 0.8 = 2.4$ volts peak, so that at maximum input the L.F. grid voltage of the triode will swing between -0.6 volt and -5.4 volts if the manual volume control be set at maximum. The load impedance to L.F. currents is not the D.C. resistance of the circuit, but the transformer primary impedance, and on the curves of Fig. 3 this can be represented by a horizontal straight line drawn through the intersection of the -3 volts curve with the D.C. load line. This is shown by the line CD, the points E and F representing the limits of the L.F. grid swing. These points are nearly equidistant from the -3 volts line, so that amplification will be practically distortionless.

The L.F. amplification obtained will be equal to the valve amplification factor, and at the working point this is about 34. The L.F. output on the transformer primary for maximum signal, therefore, will be $34 \times 2.4 = 81.6$ volts peak with 80 per cent. modulation. With minimum signal, of course, at which A.V.C. just commences to operate, the output will be one-half, or 40.8 volts. With a transformer having a ratio of 3.5-1, therefore, an output stage capable of handling an input of 142.5 volts can be fully loaded.

In the majority of cases, of course, the output stage requires a much smaller input, so that the manual volume control would normally be turned down to give a smaller proportion of the available L.F. potential on the triode grid. This means, of course, that the L.F. amplification is

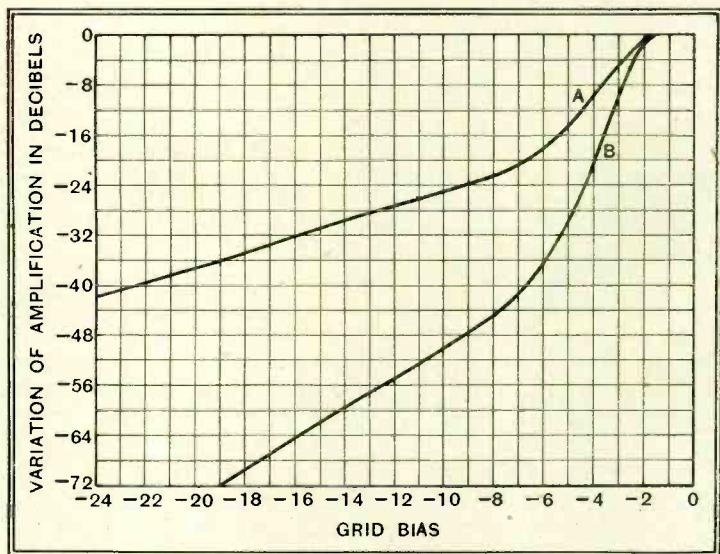


Fig. 2.—The variation of amplification with bias for one (A) and two (B) H.F. stages is shown here.

controlled valves are returned to the earth line, so that the initial cathode potential of the duo-diode-triode must be $70 + 17.5 = 87.5$ volts positive with respect to negative H.T. The drop across R4, therefore, must be 87.5 volts.

Calculating Circuit Constants

The problem of selecting the value of R4 is complicated by the presence of the decoupling resistance R3, but as this will usually be necessary we cannot afford to neglect it. Let us assume that we shall lose 50 volts across R3 with no signal. The voltage available across the valve and the cathode resistance R4 will then be the total H.T. voltage less the drop in R3 or $270 - 50 = 220$ volts. Fig. 3 shows the anode volts-anode current curves for the triode portion of the MHD4, and from this we can immediately derive the values of R4 and R3. We have a total of 220 volts across the valve and R4, and we know that the drop across R4 must be 87.5 volts, so that the difference, or 132.5 volts, must be the actual anode voltage of the valve. With no-signal, the triode grid potential will be about -0.7 volt, so that we can immediately read off the no-signal anode current of the valve, and this is equal to 4.8 mA.

We have, therefore, to drop 87.5 volts at 4.8 mA. in R4, which must thus have a value of 18,250 ohms, and 50 volts at the same current in R3, which must be 10,400 ohms. It should be noted that we have assumed that the L.F. trans-

this represents the A.V.C. bias. The figures in question can be obtained from Fig. 4 by deducting the potentials less than 70 volts (the difference between the earth and negative H.T. lines) from 70 and ignoring the potentials greater than 70, for the diode A2 is then non-conductive. We thus obtain the curve of Fig. 5.

Now for the strongest signal we need a bias of 17.5 volts, and Fig. 5 shows the grid potential necessary to give this bias, and it will be seen to be 2.95 volts, or, say, 3 volts. With this bias there will be no grid current flow in the triode, so the diode A1 must provide 3 volts bias as a consequence of rectification. Curves for

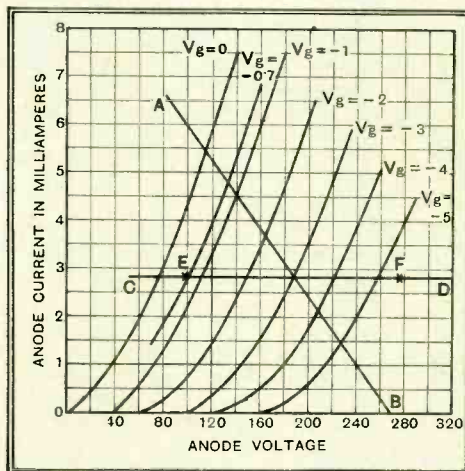


Fig. 3.—Anode-volts-anode-current curves of the MHD4 duo-diode-triode used in determining the operating conditions.

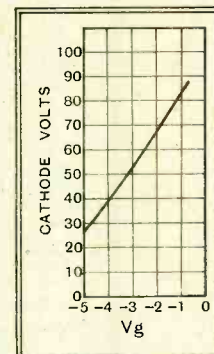


Fig. 4.—The variation in cathode potential for various grid bias voltages is shown here.

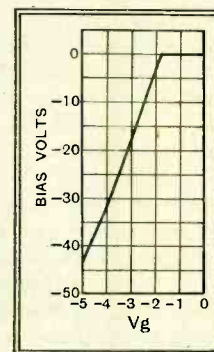


Fig. 5.—This curve shows the A.V.C. bias voltage available for various grid voltages on the MHD4

Delayed Amplified A.V.C.—

really excessive, but it can be turned to good account when it is desired to receive really weak signals which do not provide sufficient output at the normal setting of the control.

Now, in the previous article describing delayed diode A.V.C., it was assumed that the maximum input to the first H.F. valve would be 5 volts R.M.S. and the minimum 1 millivolt, and it was shown that the stage gain required from each H.F. valve to fulfil the conditions led to a figure difficult to attain in practice owing to instability troubles. Let us, therefore, calculate the gain required in this case for the same input figures. The detector input for A.V.C. threshold is 1.5 volts R.M.S., and the first H.F. valve input 1 millivolt, so that the amplification must be 1,500 times, or 38.7 times per stage. This is a very reasonable figure, and quite in accordance with modern practice for two H.F. stages.

It will thus be seen that amplified A.V.C. offers considerable advantages over the simpler diode circuit, for the D.C. amplification of the bias potentials which is obtained reduces the amount of H.F. amplification necessary for good automatic volume control. Its sole disadvantages are the greater circuit complication and the need for providing a steady potential which is negative with respect to the earth line.

The Choice of Circuit

Although it has been shown that amplified A.V.C. is superior to diode A.V.C. for the particular case which we have considered, it must not be thought that it is always so. The type of receiver taken as an example is a common one, and, therefore, it is true to say that amplified A.V.C. is usually better than the simpler diode controls. Much depends on the total pre-detector amplification, however, and in the case of a superheterodyne, where three stages can often be controlled, amplified A.V.C. may indeed prove disadvantageous and the difficulties of the delayed diode control are reduced. Moreover, in these two articles neither delayed diode A.V.C. with L.F. control nor delayed square law A.V.C. has been considered. The whole question as to the choice of an A.V.C. circuit may be summed up by saying that no one method is generally the best, and the best system for any particular receiver will depend upon the design of that set.

HINTS AND TIPS BOOKLET

With the issue of October 6th, a special supplement will be included in the form of a 32-page Booklet of practical *Hints and Tips*, specially compiled by the staff of THE WIRELESS WORLD.

DISTANT RECEPTION NOTES**More Power Increases on the Continent**

PLANS for increasing the power of the Paris PTT station from 7 kilowatts to 120 have recently been approved. The new transmitter is to be situated at Villejuste, twelve miles outside the city, though the studios will remain in Paris itself. Under the Lucerne Plan the wavelength of the station will be 431.7 metres, and it will

A correspondent tells me that he received an American station recently at very great strength on 348.6 metres. This is WABC, the 50-kilowatt station of the Columbia broadcasting chain situated in New York City.

Is Berlin Witzleben's new transmitter now in use from about 10.30 p.m. onwards? I find the station quite weak, if indeed it is audible at all, during the early part of the evening; but later on it comes in with fine strength. Any reader who has not recently received Witzleben should certainly try for it now.

Recommended Transmissions

There is intermittent interference still with Huizen from a Russian station, though I have not often found it troublesome of late.

The long-wave stations are all in good form. Oslo in particular is showing remarkable strength.

The stations at the top of the medium waveband have now definitely returned to good strength, good reception being obtainable from Budapest, Munich and Vienna. On one recent evening, however, Vienna had a strong background which appeared to come from Riga. If so, the Latvian station must be working rather below its normal wavelength. Florence is still heterodyned on many evenings, and Turin suffers badly in the same way.

Beromünster, Frague, Rome, Toulouse, Strasbourg, Breslau, Hilversum, Heilsberg, and Trieste are outstanding medium-wave stations, though there are many others from which first-rate reception is regularly obtainable.
D. EXER.

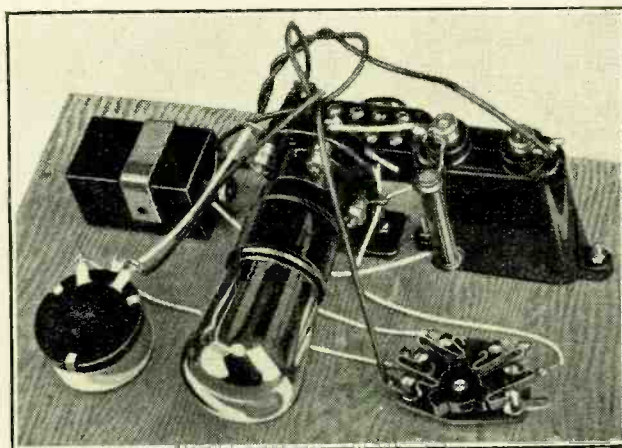


Fig. 6.—The Wireless World A.V.C. Unit is an example of one form of amplified automatic volume control.

have Belgrade on one side and Stockholm on the other as next door neighbours.

Extensive alterations will be required at the Muhlacker station of Stuttgart to increase the output power to 100 kilowatts and the wavelength to 522.6 metres. For this reason the station is now silent until 4 p.m., and it will be closed down entirely from the middle of October until the beginning of December, the old 1.5 kilowatt transmitter taking on the service.

A correspondent writes to ask why I so frequently mention Katowice as a good station since in his area "it has not been worth two minutes' attention since the winter before last." Curiously enough he lives not more than thirty miles from me, and I find Katowice one of the strongest and most reliable of Continental stations from about 8 p.m. onwards. His trouble, I think, is that lack of selectivity prevents him from separating Katowice from Athlone and Söttens.

American Stations

In a recent note I suggested that we ought soon to be hearing more of American stations with wavelengths above 300 metres. Up to the end of last month very few transatlantic stations with wavelengths higher than this were at all well heard, though several of them could be received rather feebly. I can now report excellent reception of WGY on 379.5 metres and WJZ on 394.5 metres.

FOREIGN BROADCAST GUIDE**BUCHAREST**

(Roumania).

Geographical position: 44° 25' N.; 26° 2' E.

Approximate air line from London: 1,300 miles.

Wavelength: 394.2 m. Frequency: 761 kc/s. Power: 12 kW.

Standard time: Eastern European (G.M.T. plus 2 hours) (Roumania adopts Summer Time).

Standard Daily Transmissions.

10.00 B.S.T., Sacred service (Sun.); 13.00, gramophone records, news; 17.00, concert, news, weather; 20.00, main evening entertainment; 22.15, dance music, news, weather.

Announcer: Woman.

Call: (Phon.) *Atent-see-oon-aye ah-eetch-ee rah-dec-owe Book-oo-recht-ee*. Announcements are all made in the Roumanian language, but occasionally also in French, German and Italian.

Interval signal: The following bars of a Roumanian Folk Song, *Hai Lelitzo* repeated *ad lib*.



Closes down with good-night greetings (in Roumanian), *Buna seara tuturor*, repeated in different languages and followed by *Traiasca Regele* (National Anthem) played on a gramophone record.

* A high-power transmitter is under construction.

UNBIASED

By
FREE GRID



A Snake in the Grass

RECENTLY, when I happened to be staying at the home of a rather unpleasant sister-in-law, I was rudely awakened one afternoon, while taking a siesta in the garden, by a demand to "come and see what's wrong with the wireless." With many muttered imprecations I bestirred myself and went into the house, where I found that electrical interference of a particularly objectionable type was drowning everything.

All my efforts to stop the trouble failed, and after spending many days experimenting with various forms of interference suppressors and a goodly portion of my sister-in-law's money in purchasing the necessary gear, I dropped everything and took to detective work. After a fruitless search of the neighbourhood I had almost given the job up as hopeless when I observed that the trouble seemed to coincide with the mechanical rattle of a mowing machine a few gardens away. Naturally I immediately suspected radiation from the ignition system of a motor mower, and I hastily went upstairs to make closer observation from a bedroom window.

To my surprise nothing was in view save a perspiring little man pushing a heavy-looking mower of a more or less conventional type under the direction of an imperious-looking female of amazonian proportions. I was about to turn away when the servile little serf took advantage of a momentary disappearance of his chain-gang overseer to stop and mop his brow. To my utter amazement the mower, though standing still, continued to mow. Hastily calling for a telescope I took a further observation, and noticed a snake in the grass in the form of a cable running from the machine to the house.

I immediately consulted a large firm of mowing machine makers on the 'phone concerning this strange phenomenon, and was told that this was a new type of machine which was rapidly becoming universal; only the knives were driven by the electric motor. The older type, in

which the whole machine was electrically driven, had been superseded, because members of the so-called fair sex had been in the habit of forgetting to switch off when stopping to chat with a neighbour over the fence, with the result that the machine had run amok, lopping off flowers, bushes, babies, dogs, and other impedimenta in its mad career.

My New Down Lead

IN spite of all the progress that has been made in radio, we are still faced with the incongruous sight of a set housed in a beautiful piece of cabinet work connected up to the aerial by a straggling wire which meanders through the house till it finally connects with the down lead. The reason for this state of affairs is that the average urban and suburban house has its garden, and, therefore, its aerial, at the back, whereas the listeners themselves, with that peculiar cussedness which endears them so much to the hearts of the B.B.C. programme staff, insist on sticking their receivers in a room in the front of the house.

It is true that there are plenty of patented indoor aerials on the market, but no matter how sensitive the set is, a lofty outdoor aerial is always to be preferred on account of the improved signal-strength-to-noise ratio which it gives. The same argument holds good against a set which employs a frame aerial or a "mains" aerial.

I flatter myself that I have solved the problem in a manner which greatly redounds to my credit. The arrangement I have fixed up is really very simple. All that I have done is to fix a length of screened aerial down lead under the floorboards so that one end terminates at a



A straggling wire.

wall plug, the other end, of course, carrying on outside the house until it gives place to the ordinary down lead.

I find that the losses due to this arrangement are extraordinarily small, and, of course, the lead coming from the wall plug to the set is no more conspicuous than the mains lead running from the neighbouring wall plug. As for my earth lead, this is plaited in with the mains flex, and, since I naturally use a three-point plug and socket, all difficulties of connection are completely overcome.

I find that there are very little losses even if I plait the aerial lead with the others; and so I am now waiting for an enterprising manufacturer to produce a four-point plug and socket for use in order to make the job a really neat one. Judging from my knowledge of manufacturers, however, I fear that I shall have to wait for a confoundedly long time.

Can One Steal Electrons?

I NOTICE that quite a large number of people have been prosecuted lately for stealing electrical energy from the wires of radio relay companies. In my



Carefully put back by her.

opinion none of the defendants are deserving of any sympathy save one good lady who, according to a newspaper report, has parted with the sum of £1 for "fraudulently extracting a quantity of electricity."

If the good dame will take a spot of advice from me she will appeal and, if need be, carry the case right up to the House of Lords. It may certainly have been wrong to tap the wires of the relay company and steal entertainment therefrom, but that was not the subject of the charge. I entirely fail to see how anybody can "extract" a quantity of electricity from the relay company's wires, and she could, I think, successfully plead that the electrons which she took out were carefully put back by her, as they merely flowed out of one wire, trotted round her loud-speaker windings, and then went back to the company by the other wire. If the lady cares to take action she is assured of my full moral support.

The Electrostatic Loud Speaker

II. Matching Loud Speaker and Output Valve

By M. G. SCROGGIE, B.Sc., A.M.I.E.E.

WE have seen the fundamental difference between the electrostatic loud speaker and all other types. Before it can be effectively used it is necessary to consider it as a load in a valve circuit.

A moving-iron speaker can be considered approximately as an inductance. A moving-coil speaker is conveniently (but not very accurately) assumed to be a resistance. An electrostatic speaker may be represented as a capacity, perhaps not quite so pure (i.e., free from resistance) as the very best condensers, but one does not go far wrong in neglecting the impurity.

It has already been explained that the effect of a voltage between the two plates is to draw them closer together. Therefore, one would expect the capacity to be increased thereby, and this is exactly what happens. Fig. 1 shows the measured capacity of a "Primustatic" loud speaker with an 18in. by 20in. diaphragm. The capacity averages about 0.008 mfd. per square foot, or a reactance of about 20 megohms divided by the frequency in cycles per second.

The Load Diagram

In drawing load curves on a valve diagram the loud speaker is usually represented by a straight line, which means a resistance, constant at all frequencies. No loud speaker ever does act just like that, but a moving-coil type is near enough to it over the middle range of frequencies for

one to get at least a hazy idea of how to match it to the valve. Our condenser speaker has this advantage at least, that it is very closely a capacity load, but, unfortunately, it is therefore not a straight line at all, but an ellipse, and one of a different size at every frequency. So it is rather an exasperating business trying to fit it comfortably into the valve diagram. To start with, it would be worse than manufacturing a "Mickey Mouse" film to draw a diagram for every frequency, so let us select three only—80, 800, and 8,000. The respective reactances of a 2½ square foot speaker are 100,000, 10,000, and 1,000 ohms,

There are two ways in which these figures can be altered to suit the valve: first, by selecting a diaphragm of different area, and, secondly, by using a step-up or step-down transformer, which has the effect, looked at from the primary side, of multiplying the reactance by the square of the transformer ratio. A step-up is equivalent to an increase in capacity. But it is inevitable that with any one arrangement the reactance must vary over the same range as the frequency.

The result of this characteristic is that the behaviour is strikingly different according to whether a triode or a pentode is used. Fig. 2 shows a diagram for a triode with an internal resistance (impedance) of about 2,500 ohms, and the three reactance ellipses have been drawn in to show what happens at the lowest, middle, and highest frequencies. The ellipses in each case are the largest that can go in without running into grid current on the left, or bottom-bend rectification at the foot.

At 80 cycles the full grid excitation is possible; that is to say, the grid voltage can be swung right from zero on one side to double the bias voltage on the other, without any possible risk of overloading due to rectification. The voltage

THE electrostatic loud speaker is unique in presenting a capacitive load to the output valve, and the conditions necessary to prevent distortion and overloading are essentially different from those of moving-iron or moving-coil types.

developed across the loud speaker is the maximum possible.

Permissible Grid Volts

At 800 cycles it is just possible to give it the full grid, but the ellipse has opened out so much that it is approaching the danger zone along the foot. Still, it is working quite happily and developing practically the full voltage. At any higher frequency, however, the lower half would be flattened out, unless the whole ellipse were reduced in size by reducing the grid input. This is well shown at the upper extreme of 8,000 cycles, where the grid excitation must be reduced to less than a half in order to avoid rectification distortion, and the anode voltage developed across the loud speaker dwindles to about a tenth.

These features are illustrated rather more concisely in Fig. 3. Curve A shows the maximum peak volts that can be applied to the grid without overloading, and curve B shows the voltage developed across the loud speaker with maximum grid volts as given. In each case the voltage is level up to a certain critical frequency, in this case 800 cycles, after which it rapidly falls.

It must not be hastily concluded that the response suddenly falls off above 800 cycles, for it must be emphasised that curve B is strictly dependent on A, and shows the maximum output short of overloading the valve.

P. P. Eckersley has shown experimentally that in normal broadcasting the amplitudes to be expected at the upper frequencies are considerably lower, and would come well below curve A. In addition, by-pass condensers, H.F. tuning characteristics, and other factors are almost certain to prevent the grid voltage from breaking the allotted bounds. So if the grid excitation is kept at a level six volts throughout, as it can be without fear of overloading (curve A'), the output is as shown by B'.

Another point is that it is the falling part of curve B', rather than the level part, that is correct. The amplitude of diaphragm required to give a constant

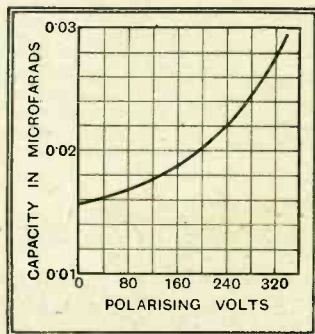


Fig. 1.—Variation of capacity with polarising voltage in the "Primustatic" 18in. x 20in. loud speaker.

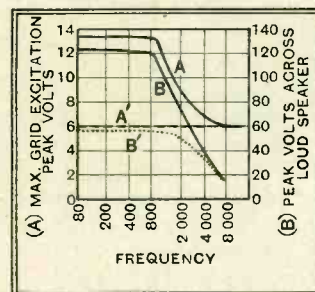


Fig. 3.—Curves showing maximum permissible grid volts with capacity load.

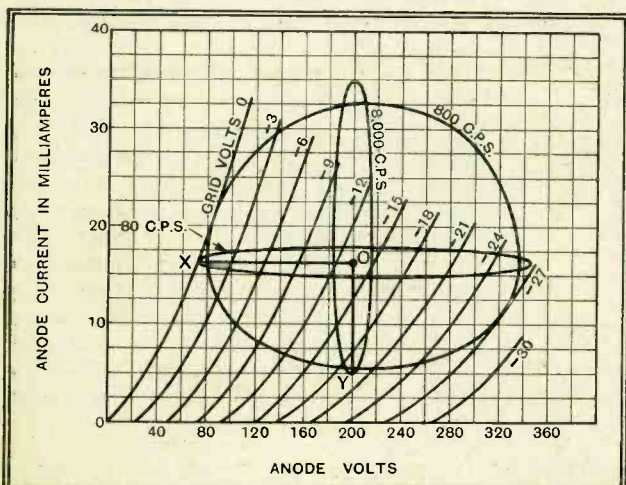


Fig. 2.—The load ellipse of an electrostatic loud speaker varies in shape and inclination as the frequency changes.

The Electrostatic Loud Speaker— output of sound gets steadily less as the frequency rises. It is not possible to state exactly what is the ideal characteristic

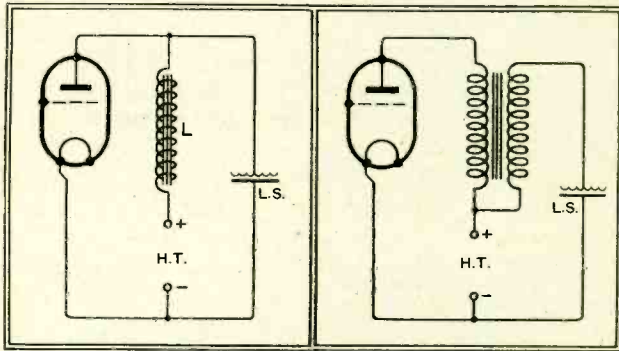


Fig. 4.—Choke coupling provides the simplest connection between valve and loud speaker.

Fig. 5.—Connections for applying polarising voltage with transformer coupling.

without knowing exactly how the particular type of diaphragm behaves at various frequencies; but a listening test with a constant-amplitude pure tone shows a satisfactory response down to about 800 cycles, and a falling response below that.

The Critical Frequency

We can calculate this critical frequency by measuring the distance in anode volts horizontally from the initial working point O on the valve diagram to the zero grid voltage point X, and dividing this by the vertical distance, in anode milliamps, from O to Y, the minimum current consistent with avoiding severe curvature. This gives the reactance in thousands of ohms, which is also equal to $\frac{1,000}{2\pi fC}$, where f is the frequency and C is the capacity in microfarads; so it is easy, knowing C, to calculate f. By altering C in either of the two ways already described it is possible to shift the critical frequency f, thus extending either the level or the falling part of the curve.

As it has just been stated that it is the falling part that is correct, it would seem that the sensible thing to do would be to make the critical frequency as low as possible. That means making either the actual capacity or the step-up ratio as large as possible. An additional allure-ment is that an increase in capacity means an increase in sound-radiating surface, and an increase in step-up means an increase in signal voltage, and in either case it looks as if the volume would be increased without any greater expenditure of power. But, while it is true that there is improved *uniformity* of response, the improved *efficiency* fails to materialise; for curve A is shifted to the left too, and necessitates severely cutting down the input. And, as the lower tones are less audible than the upper, there is an apparent falling-off in volume, and in endeavouring to restore it by the volume control the only result is rattling and distortion. If, on the other hand, the capacity is too small, the volume again drops, and what output there is consists almost entirely of extreme top.

Hence a compromise is necessary, giving a reasonable efficiency at the upper fre-

quencies, the lower being augmented, if necessary, by a bass moving coil unit.

To descend for a moment from these theoretical reasonings to consider how the connection is made in practice, the simplest circuit is that of Fig. 4, where L is a choke of high inductance capable of carrying the valve anode current. In this way the loud speaker receives both the output voltage from the valve and the steady polarising voltage from the H.T. source. The choke behaves as a 1:1 transformer, and if its inductance is sufficiently high it by-passes a negligible proportion of the "signal," and so the whole arrangement conforms very closely to the preceding theory. It may be of interest to realise that at one particular frequency the imped-

the anode current rising much above normal.

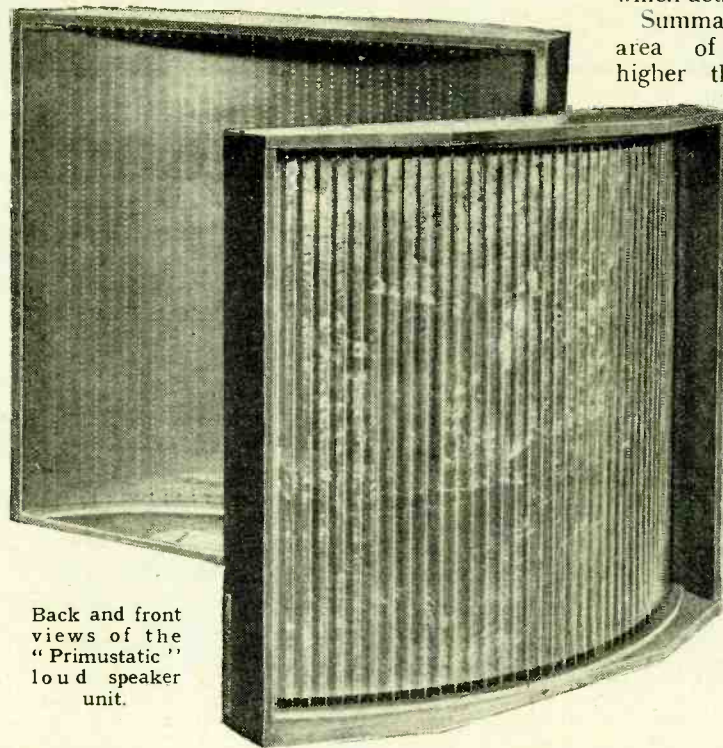
If a transformer is used to alter the ratio it is essential to allow for the polarising voltage (Fig. 5), and if it is a step-up ratio it may be desirable to add some auxiliary voltage, but only if the H.T. voltage itself is rather low. An old dry battery can be used, as no current is drawn. If the secondary is linked to the anode end of the primary the sum or difference of the voltages across both windings is obtained, giving a choice of three ratios altogether.

Push-pull Connections

A push-pull stage is much to be recommended, and Fig. 6 shows one method of connection. If there is no secondary winding, or if it is being used for another loud speaker, the connection of Fig. 7 is another of the many schemes. Although this looks a one-sided arrangement, it actually loads the whole transformer, which acts as a 2:1 step-down.

Summarising: the larger the area of diaphragm, or the higher the step-up, the lower

is the frequency below which response falls off. But the lower also is the efficiency and the greater the tendency to rattle. So only when there is plenty of power available in the last stage is it possible to arrange these matters so as to go low down the scale. The smaller the number of milli-watts available the higher must be the critical frequency. A dual speaker combination is in any case the best for effective reproduction over the whole audible scale.



Back and front views of the "Primustatic" loud speaker unit.

ance of the anode load is almost infinite, due to the resonance of choke and loud speaker, and is also a pure resistance, and hence a nearly horizontal straight line instead of an ellipse. With normal components this frequency is about two or three hundred cycles, but the phenomenon does not appreciably modify the performance as already described. The whole action is very beautifully confirmed by cathode ray oscillograph tests, using a variable-frequency oscillator. Beginning at the lowest frequencies, we see the "lengthwise" ellipse become a straight line, and then open out into an "upright" ellipse, which, unless the input is reduced, causes terrible overloading.

Methods of obtaining this, together with tone control, and the conditions for pentode operation, will next be considered.

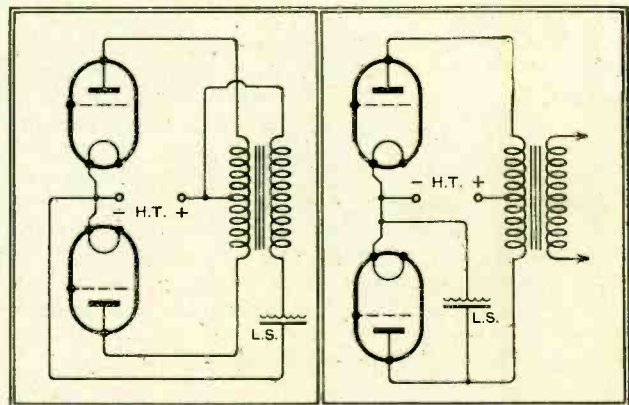
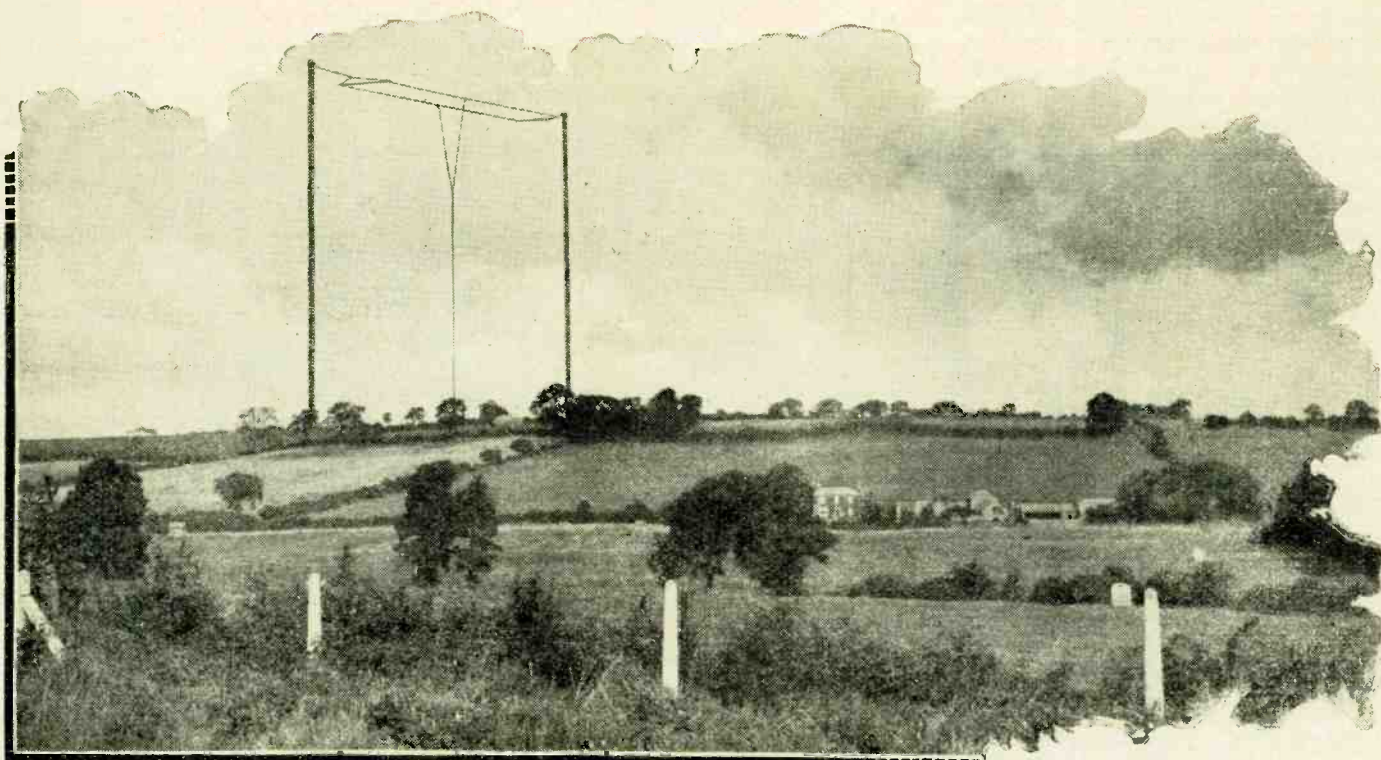


Fig. 6.—Push-pull output using transformer secondary winding to energise the loud speaker.

Fig. 7.—This circuit gives a 2:1 step-down and leaves secondary free for an additional loud speaker.



How the Signal Reaches Your Set

Modulation and the Purpose of the Carrier Wave Explained

By S. O. PEARSON, B.Sc., A.M.I.E.E.

As one listens to an item in a broadcast programme one can readily appreciate that the sound waves emanating from the diaphragm of the loud speaker must bear a very close resemblance in form to those actuating the microphone at the broadcasting station. If this were not so the sounds received would be unpleasantly distorted, if not unintelligible, for the smaller the degree of wave-shape distortion in the sending and receiving systems the more realistic and true to life is the reproduction.

The air vibrations, or waves of rarefaction and compression representing sound, extend over a considerable range of frequencies. The upper and lower limits of this range, however, are not very sharply defined, depending to a very large extent on the intensity of the sound and to some extent on the individual listener. In general, audible frequencies may be considered to extend from about 16 cycles per second at the lower end of the scale to perhaps 10,000 cycles per second or more for the highest notes. In the case of orchestral music practically the whole of this range of frequencies is involved, the highest frequencies representing the overtones of violins, etc. Ordinary speech involves a frequency range from about 100 cycles per second to 5,000 cycles per second or so. Intelligible speech can be transmitted on a much narrower band of frequencies, but when this is done the speaker loses the essential characteristics of his voice, which convey to some extent an impression of his personality. So to obtain realistic reproduction at the receiver all frequencies must

THE most vital principle of wireless communication is that of modulation of the carrier wave. The purpose of the carrier wave is often not properly understood, yet no real conception of what happens in a receiver can be gained without a grasp of this fundamental principle.

be delivered by the loud speaker in their correct relative amplitudes.

Need for the Carrier Wave.

At the transmitting station the microphone converts the sound waves impinging on its diaphragm into electrical variations of the same wave form, and consequently these electrical variations are represented by frequencies which all lie within the audible range. These frequencies are usually referred to as "low frequencies" or "audio-frequencies," to distinguish them from the very much higher frequency of the oscillations in the aerial system. The necessity for high-frequency oscillations will now be briefly explained.

A little thought will make it quite clear that the audible frequencies cannot be directly transmitted through the ether because, for one reason, every station would have to operate over the same range of frequencies and selection would be impossible; the transmitting station must

send out from its aerial system a train of ether waves of fixed frequency in order that distant receivers may be accurately tuned to it. And, further, the frequency must have a very high value compared with the frequencies within the audible range, the main reason for this being that the efficiency of an aerial as a radiator of energy falls off very rapidly as the frequency is lowered. The efficiency of radiation is proportional to the square of the frequency. The lowest frequency used for ordinary broadcasting purposes is about 155,000 cycles per second, corresponding to 1,935 metres wavelength; and the shortest wavelength stations operate with a frequency in the neighbourhood of twenty million cycles per second!

The constant-frequency waves emanating from the transmitting aerial are made to serve as the means of conveying the low-frequency or speech-frequency variations, representing the matter to be broadcast, from the transmitting station to the various receiving aerials. For this reason the train of high-frequency waves, upon which the low-frequency variations are to be superimposed, is known as the "carrier wave," and we are mainly concerned here with the manner in which the audio-frequencies are combined with the carrier frequency and separated out again in the circuits of the receiving set.

Now in the first place it must be remembered that the carrier frequency is far above the highest audible frequency, and could not possibly produce any sound on its own account. During an interval between two items in a programme silence

How the Signal Reaches Your Set— reigns (or should), although the carrier wave is being received at full strength the whole of the time. In order to convey an audible note from transmitting aerial to receiving aerial the intensity or amplitude of the carrier wave must be made to vary at the audible frequency in accordance with the wave-shape representing the note in question, and this process is referred to as "amplitude modulation." The amplitude of an oscillation is the maximum or peak value reached in each direction, and the low-frequency variation of the amplitude of the high-frequency carrier wave enables the audible note to be carried across.

A numerical example will be helpful in explaining the principle of amplitude modulation and in giving a sense of proportion as regards relative values. Suppose, for instance, that the frequency of the oscillations in a transmitting aerial is 1,000,000 cycles (1,000 kilocycles) per second, being the frequency of a station working on 300 metres. Currents of the same frequency are set up in the tuned circuits of a distant receiver, but when these currents have constant amplitude no sound would be given out by the loud speaker, a million cycles per second being far outside the audible range of frequencies.

Now suppose that the 1,000 kilocycle carrier wave is to convey between the transmitting station and the receiving aerial a single pure note of 500 cycles per second, being represented by a sine wave of this frequency. Then, by some suitable means, the high-frequency oscillations in the transmitting aerial are made to vary in amplitude, about the mean value, at a frequency of 500 cycles per second. Since the carrier frequency is one million cycles per second, it follows that for each cycle of the low-frequency variation (called the modulation frequency) there will be 2,000 high-frequency oscillations.

The constant-amplitude sine wave of Fig. 1 (a) represents the unmodulated

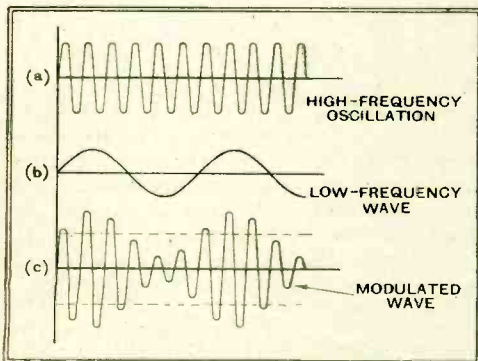


Fig. 1.—Diagram showing how the amplitude of a high-frequency oscillation is varied at an audible frequency.

high-frequency oscillations or carrier wave referred to, the frequency being 1,000 kilocycles per second. The sine wave at (b) represents the low-frequency variation corresponding to the pure tone of 500 cycles per second. By the action of the

modulating system in the transmitting circuits these two waves are combined in such a way as to give the modulated wave of Fig. 1 (c). The lines passing through the positive and negative peak values respectively of the resultant high-frequency wave have exactly the same shape and frequency of variation as the low-frequency curve shown at (b). Of course, during each low-frequency cycle there will be 2,000 high-frequency oscillations, but for convenience in drawing only a few H.F. oscillations per low-frequency cycle are shown.

It will be observed that the number of complete reversals per second is the same for the modulated wave (c) as for the unmodulated wave (a), and so it is usual to state that the modulated wave is one of constant frequency but varying amplitude. This statement is, however, not strictly correct, because the term "frequency," as ordinarily defined, only applies to a wave which repeats itself exactly cycle by cycle, and similarly as regards the term "amplitude." So it must be understood that the frequency of a modulated wave means the number of complete or double reversals per second.

Percentage Modulation

When the amplitude of a high-frequency oscillation is varying periodically above and below the mean or normal value, the degree of modulation, or depth of modulation, is expressed as a percentage of the normal amplitude of the unmodulated wave. For instance, when the modulation is 20 per cent. the amplitude of the high-frequency oscillation varies between limits 20 per cent. above and 20 per cent. below the mean value. It is possible to modulate to a depth of 100 per cent., that is to say, to vary the amplitude of the high-frequency oscillations between zero and twice the normal value, but for practical reasons connected with the quality of reproduction at the receiver it is not usual to modulate to a greater depth than about 50 per cent.

It has been assumed that the unmodulated carrier wave represented by the curve of Fig. 1 (a) is a pure sine wave, and, this being the case, the modulated wave of Fig. 1 (c) is very frequently referred to as a high-frequency *sine wave* whose amplitude is varying periodically at the low, or modulation, frequency. This description, however, as already pointed out, is not strictly correct, for it is quite evident that the change in peak value, cycle by cycle, is brought about by changing the *shape* of each H.F. wave, the number of reversals per second being unaltered. But in the case under consideration there are 2,000 high-frequency oscillations to a low-frequency cycle, and so the difference in the amplitudes of two successive H.F. oscillations is very small indeed, their ratio being practically unity. Consequently, the extent to which the high-frequency oscillations depart from the true sine shape is extremely small, and the statement referred to above as being inaccurate may be employed in a

descriptive sense. The idea of a sine wave gradually varying in amplitude is easy to understand; but such a statement would not be—indeed it could not be—tolerated by a mathematician working out the detailed theory of modulation.

Conditions at the Receiving End

The modulated ether waves reaching a receiving aerial set up in the latter high-frequency electromotive forces which vary in exactly the same way as the currents in the transmitting aerial. So when the H.F. oscillations in the sending system are modulated in any particular way, the resulting high-frequency electromotive forces in the receiving aerial are similarly

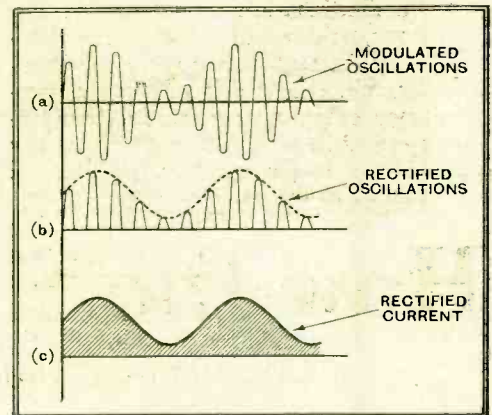


Fig. 2.—The curves show the process of separating out the low-frequency component from a modulated wave by means of a rectifier or detector.

modulated. Now if the receiving aerial circuit behaved like a simple resistance the currents set up in it would be at all times proportional to the voltage, and the resulting H.F. currents would be an exact replica of the currents in the transmitting aerial.

This would be a most desirable state of affairs, because the object is to obtain in the loud speaker an audio-frequency current which is as nearly as possible a true copy of that in the microphone circuit at the transmitting station. But it is a well-known fact that a sharply tuned receiving circuit has a modifying effect on a modulated high-frequency oscillation, the effect being to lessen or attenuate the degree of modulation.

The reason for this demodulating effect is that a certain amount of energy is stored in the tuned circuit when oscillations are present; this stored energy oscillates between the magnetic field of the coil and the electrostatic field of the condenser. The result is that any change in the amplitude of the high-frequency oscillation involves a change in stored energy, which is proportional to the square of the amplitude. Now it is a fundamental law of physics that energy cannot be accumulated or expended instantaneously, the result being that the high-frequency oscillations tend to resist any change in their amplitude, in the same way that a moving body, which possesses inertia, resists any change in its motion.

How the Signal Reaches Your Set—

The weakening effect is greatest at the highest modulation frequencies, so that the high notes tend to be reduced in greater proportion than the low ones. However, when the tuning is not too sharp, or when special filter circuits are employed, the quality of reproduction is not seriously affected on this score.

Function of the Detector

The modulated H.F. potential difference set up across the last of the tuned circuits in a receiver cannot be made to operate a loud speaker directly because, referring to curve (a) of Fig. 2, it will be seen that the curve is symmetrically placed about the zero line. Consequently, although the H.F. oscillations are modulated at low frequency, there would be no low-frequency current set up in the loud speaker coil. For this reason the low-frequency component or modulation frequency must be separated from the carrier wave again at the receiver, and this is the function of the detector stage.

The detector almost invariably takes the form of a rectifier, that is, a device which completely or partially cuts off all the negative half waves of the modulated oscillation by the property of possessing one-way or unilateral conductivity, in the manner shown by curve (b) of Fig. 2. A perfect rectifier could be defined as one which offers a constant resistance to current flowing in one direction, irrespective of the value of the current, but which allows no current whatever to flow in the opposite direction when the applied voltage is reversed. The static characteristic curve of a perfect rectifier is shown in Fig. 3 (a); the current is proportional to positive values of applied voltage and zero for negative values.

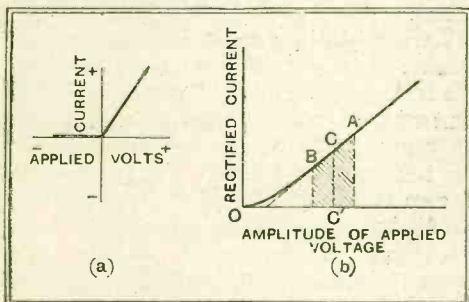
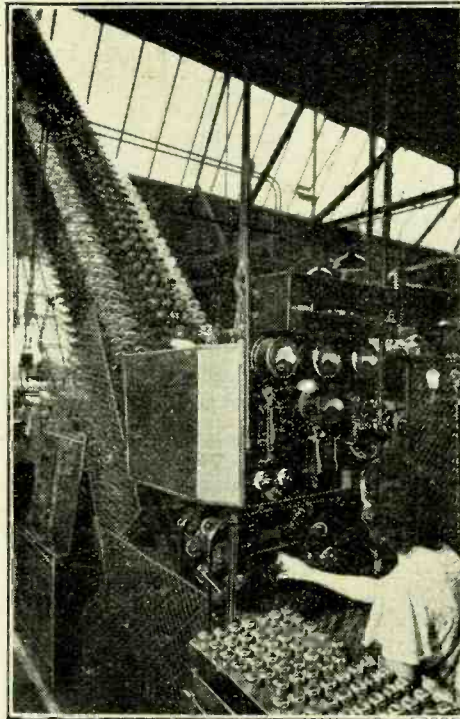


Fig. 3.—(a) The voltage/current or static characteristic curve of an imaginary perfect rectifier. (b) Representative rectification characteristic curve of a valve detector, such, for instance, as a diode.

With such an arrangement the resulting unidirectional current produced when an alternating voltage is applied will have a *mean value* proportional to the amplitude of the applied voltage. If the applied voltage has constant amplitude the successive current pulsations will all be equal, but when a modulated high-frequency voltage is applied to a perfect rectifier the unidirectional current pulsations will vary in amplitude in accordance with the audio-frequency variations as shown at (b) in Fig. 2. By smoothing out the radio-fre-



On this equipment at the Cossor valve works valves are carried on a continuously moving band. After first being gettered, the valves are run under operating conditions to stabilise their characteristics before testing.

quency variations with the aid of a suitable condenser filter the resulting rectified current fluctuates at the low frequency, being at all times proportional to the *amplitude* of the high-frequency oscillation as indicated by the dotted-line curve. Consequently, with a perfect rectifier, proportionality is fully maintained and no distortion of the audio-frequency wave-shape is introduced.

In practice it is usual to employ a thermionic valve of some kind as "detector," but, although there are several possible systems, there is not one which gives theoretically perfect rectification, because the relationship between the amplitude or R.M.S. value of the applied high-frequency voltage and the resulting rectified current is never represented by a straight line; they are not truly proportional to each other. This, of course, means that the effective resistance of the rectifier depends to some extent on the value of the applied voltage oscillation. Fig. 3 (b) gives a dynamic characteristic curve of a typical valve detector; although the curve is practically straight over a considerable portion of its length it is more or less curved at the lower end, and if the straight part is produced back it does not pass through the origin O.

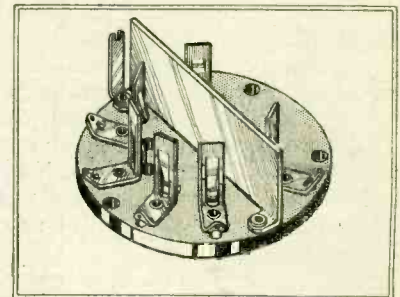
Now if a high-frequency voltage, modulated to a depth of 100 per cent., were applied to a rectifier with such a characteristic, the rectified current would obviously not conform strictly to the variations in amplitude of the applied voltage, and distortion would result. But, as stated previously, in practice 100 per cent. modulation is rarely ever encountered and with a lower percentage modulation, distortionless rectification can be attained even though the rectification

characteristic is curved at the bottom. This will be the case if the modulation is sufficiently shallow to ensure that the oscillation voltage amplitude fluctuates between upper and lower limits represented by two points such as A and B on the straight part of the curve, the wave, when unmodulated, having an amplitude OC' represented by C midway between A and B. In these circumstances the change of rectified current is proportional to the change of applied voltage, being the necessary condition for distortionless rectification.

It should be realised that this condition can only be realised if the mean amplitude OC' of the applied high-frequency voltage is sufficiently large to ensure that the upper and lower limits A and B, with the maximum degree of modulation, fall on the straight part of the curve. If the signal voltage were too low rectification would take place round the bend of the curve, with accompanying distortion. Consequently, for the reception of all but the strongest local transmissions it is essential to employ one or more stages of high-frequency amplification before the detector.

HIGH-VOLTAGE VALVES

SEVERAL interesting developments have taken place in the design of Ostar-Ganz high-voltage valves, which, as most of our readers are aware, have heating elements designed for direct connection to either D.C. or A.C. mains of standard voltages without the intermediary of resistances or transformers.



Under-side of the new Ostar-Ganz valve-holder, showing screening plate.

Hitherto it has been impossible to obtain really high anode voltages from the indirectly heated rectifiers of the series; this difficulty is now overcome by the introduction of a voltage-doubling rectifier, which costs 22s. 9d. With a 220-volt supply a rectified output of about 440 volts is obtainable at 40 milliamps. Another new rectifier provides full-wave rectification.

The K.3560 three-electrode output valve is another interesting innovation; it has an A.C. resistance of only 500 ohms and a mutual conductance of 6 mA/V. The maximum D.C. anode dissipation is 15 watts, and the valve is specially designed to give a large output with normal supply voltages.

It has previously been necessary to employ double smoothing chokes in circuits employing Ostar-Ganz valves. The need for this special smoothing system has now been avoided by alterations in the arrangement of the pins and by the introduction of a special valve holder, in which the heater connections are effectively screened.

The agent for Ostar-Ganz valves in Great Britain is Mr. Eugen Forbat, of 28-29, Southampton St., Strand, London, W.C.2.

News of the Week

Current Events in Brief Review

The Passing of a Giant

WE understand that one result arising out of the Lucerne Conference is that the famous Eiffel Tower Broadcasting Station will cease its transmission on January 1st, 1935.

Marking Foreign Valves

THE Board of Trade's Standing Council recommends that certain imported wireless and rectifying valves should be plainly marked with the country of origin. The valves specified are thermionic valves having an anode dissipation that does not exceed 50 watts, and rectifying valves not exceeding a capacity of 60 volt-amperes or passing a current of more than one ampere. Such valves to carry a durable mark in a contrasting colour on the bulb or cap and a corresponding indication to be printed or stamped on the carton or container in which they are exposed for sale.

Guided by Music

AEROPLANE pilots in America find the broadcast programmes a pleasant means of whiling away the monotony of long flights, tuning back and forth from the special wavelengths carrying weather reports, direction signals, and landing instructions to their favourite broadcasting station along the route. The use of the direction-finding aerial makes it possible for a pilot while listening to a programme from WOR, for example, to know that he is heading in the right direction for the Newark airport.

The Obsolete Crystal Set

IT is stated that one of the advantages to be gained by the new P.T.T. high-power station is that owners of crystal sets in Paris and its suburbs will be able to receive the programmes throughout the day, but the result of the return of the sets made in accordance with the new licence regulations would show that the declaration of crystal sets is negligible, those possessing these relics of the past are no longer using them. Strictly speaking, they are bound to declare them, but it is unlikely that the administration will go to the trouble of prosecuting them for their neglect.

Dr. Giesecke Returns Home

AMONG the various broadcasting chiefs who were recently compulsorily retired and sent to the internment camp at Oranienburg was the former Vice-President of the Broadcasting Union and Director of the Reichs-Rundfunk-Gesellschaft. We are glad to learn from our foreign correspondent that he, Dr. Giesecke, has been liberated, and that he returned home on August 23rd, though we understand that no mention of this fact appeared in the German Press.

Ultra Shorts at Sing Sing

SING SING is seeking permission to use ultra short waves to guard its prisoners. According to a Washington correspondent, the idea is that the warders would carry light-weight transmitters and receivers strapped on their backs, enabling them to converse across the prison grounds while on their beats.

Unlucky Tunis

TUNISIAN listeners want to hear French, and are loudly lamenting that they are doomed to absorb German, Italian, and other foreign comedies and lectures. Apparently the only French stations that are audible, viz., Radio Paris, Poste Parisien, Toulouse, and Algiers, are so "pursued by parasites" that five to ten minutes of listening is the utmost that can be borne.

Feeling the Economic Strain

THE Belgian Government has just decided to reduce the grant for 1933 to the National Broadcasting Institute from over

Another Arctic Station

THE 10 kW. Norwegian station now being erected at Vadsø in Finnmark claims to be the most northerly station in the world, latitude 70° 4' N. When completed it will relay the programme from Oslo.

Storms in Hungary

LOCAL thunderstorms frequently interrupt broadcast transmission in Hungary and the relay stations often have to shut down for "storm pauses." From Budapest now comes the assurance that listeners will be warned, at such times, which stations are affected and which are still continuing their transmissions, in order that they may tune in to the active station and continue to follow the programme.

Belgian Political Talks

IN view of the correspondence which has recently appeared in the English papers between three distinguished statesmen and the B.B.C. concerning the selection of speakers for the forthcoming political addresses, it is interest-

German Anti-Static Campaign

IN view of the forthcoming anti-interference law, the National Socialist Funkkammer has decided to clear the town of Baden-Baden of all man-made statics. Work has already begun under the direction of a Post Office engineer and the second burgomaster of the town, and it is hoped that by the middle of October all such interference will have ceased. The authorities have inferred that the law against man-made interference will be based on the technical requirements of the Volksempfänger (the new People's Receiver), so that every owner of this set will have clear reception without the necessity of providing shielded aerial down-leads.

Forthcoming Lectures

A NEW session of the British Radio Institution opens today (September 22nd), when a lecture will be given by Dr. L. E. C. Hughes on "The Reproduction of Sound via Radio." The meeting is to be held at 7.30 p.m. at King's College, Strand, W.C.2, and the chair will be taken by Prof. C. L. Fortescue. The Hon. General Secretary asks us to state that any of our readers who wish to attend what promises to be an interesting lecture will be welcomed. Invitation cards are available, but are not necessary for admission. The headquarters of the B.R.I. are at 36, Gordon Square, W.C.1.

R.S.G.B. Meetings

THE secretary of the Incorporated Radio Society of Great Britain has kindly sent us a preliminary list of the series of lectures which will be given on Friday evenings at 6.15 p.m. at the Institute of Electrical Engineers. The dates and subjects are:—

September 29th.—"Experiments with Portable 56 mc. Apparatus," by R. H. Hammans, G2IG.

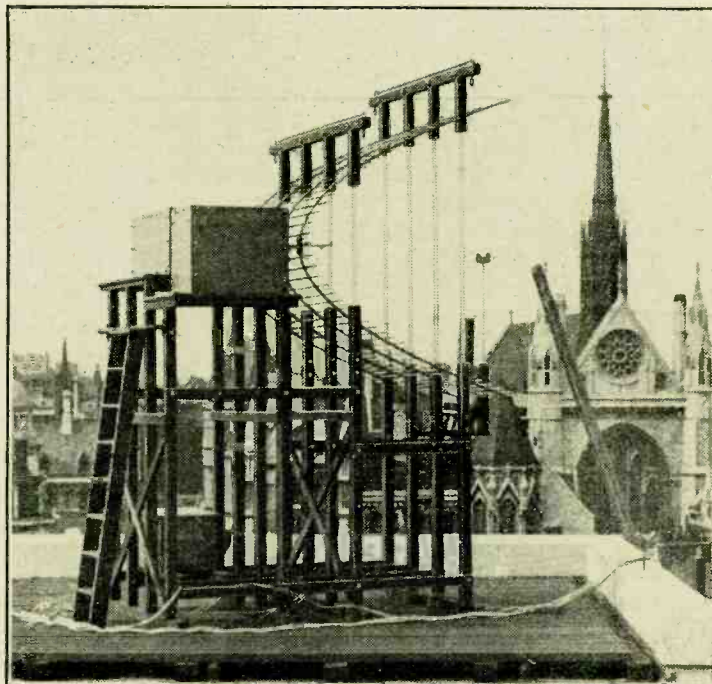
October 20th.—"Technique in Valve Manufacture," by Stephen de Laszlo, B.A. (Director, High Vacuum Valve Co., Ltd.).

November 24th.—"The Magnatron Oscillator for very High Frequencies," by Eric Megaw, B.Sc. (Research Laboratories, General Electric Co.).

December 20th.—Annual General Meeting followed by a lecture, "Transmitting Valves for Amateur Needs," by L. Grinstead (Transmitting Division, Mullard Wireless Service Co.).

New German Relay Station

A NEW relay station from Coblenz will shortly be erected and further stations are projected for Würzburg, in Bavaria, and somewhere not yet settled in Pomerania.



MICRO-WAVES AT ELECTRA HOUSE. The Research Department of Marconi's Wireless Telegraph Co., Ltd., has now settled down in its new quarters facing the Embankment, and one sign of the move is the erection of the parabolic aerial for the ultra-short wave beam on the roof of Electra House.

22 million francs to about 17 million. In consequence of this the I.N.R. (as it is generally known) has felt compelled to reduce both the talks and musical programmes. The broadcasting hours have been shortened to 12 noon to 2.0 p.m. and 5.0 to 10.0 p.m. on week-days. The Sunday transmission will start two hours earlier than this, but will otherwise be the same. It is hoped that when times improve the old hours may be restored or even extended.

ing to hear from our correspondent that the Belgian Government has issued a decree according to which "every one of its members has the right to use the broadcasting station for speeches up to a maximum of ten hours per month." If this is the case, Belgium stands in danger of being inundated with political addresses, and the prospect of an ardent politician insisting on his right to take the whole of his allotted time in "one fell swoop" must be rather disconcerting to listeners.

Manchester Show Guide—

EXHIBITOR.	STAND. Sqs.	REF.
Milnes Radio Co. ... Bingley, Yorks.	108	H 3
Mullard Wireless Service Co., Ltd. Mullard House, Charing Cross Rd., London, W.C.2.	17	C 3
NEW London Electron Works, Ltd. East Ham, London, E.6.	3	B 4
Newnes Ltd., G. 8-11, Southampton St., Strand, London, W.C.2.	11	E 3
ODHAMS Press, Ltd. 68, Long Acre, London, W.C.2.	82	G 3
Ormond Engineering Co., Ltd. Ormond House, Rosebery Ave., London, E.C.1.	67-8	C 2, C 1
Orr Radio, Ltd. 63, Lincoln's Inn Fields, London, W.C.2.	16	E 2
Osborn, C. A. Regent Wks., Arlington St., London, N.1.	78	B 1
Ospur Manufacturing Co. 26, Adam St., London, W.1.	11A	E 3
PARTRIDGE, Wilson & Co. Davenset Wks., Ervington Valley Rd., Leicester.	4	C 4
Portadyne Radio, Ltd. Gorst Rd., North Acton, London, N.W.10.	66	C 2
Practical Radio, Ltd. Stal House, Judd St., London, W.C.1.	9	E 3
Pressland Sales, Ltd. 84, Eden St., Kingston-on-Thames.	9B	E 3
Priestley & Ford. 3-11, Carrs Lane, Birmingham.	93	I 1
Provincial Incandescent Fittings Co., Ltd. High St., Manchester.	45	E 2
Pyc Radio, Ltd. Africa House, Kingsway, London, W.C.2.	55	A 2
QUICKSIGN, Ltd. 106, Queen Victoria St., London, E.C.4.	112	I 3
RADIALADDIN, Ltd. 46, Brewer St., London, W.1.	47	E 2
Radio Instruments, Ltd. Purley Way, Croydon, Surrey.	65	C 2
Radiomes, Ltd. 129-131, Bridge St., Warrington.	113	I 3
Rawplug Co., Ltd. Rawplug House, Cromwell Rd., London, S.W.7.	44A	E 2
Reproducers & Amplifiers, Ltd. Frederick St., Wolverhampton.	5	C 4
Richardsons (R.M.L.), Ltd. 21, St. John St., Manchester.	49	D 2
Ridings Reliance, Ltd. 331, Stockport Rd., Manchester.	13	D 3
Roberts, J. Bridgewater Viaduct, Knott Mill, Manchester.	112A	I 3
SIEMENS Electric Lamps & Supplies, Ltd. 38, Upper Thames St., London, E.C.1.	15	C 3
Small Power Dynamo & Motor Co., Ltd. Old Lane, H. Openshaw, Manchester.	99	I 2
Sovereign Products, Ltd. 52-1, Rosebery Ave., Clerkenwell, London, E.C.1.	100	I 2
Standard Telephones & Cables, Ltd. 364, Gray's Inn Rd., London, W.C.2.	38	E 3
Star Radio Products, Ltd. 11, Sugar Lane, Manchester.	102	I 2
TANNOY Products, Ltd. Dalton St., West Norwood, London, S.E.27.	87	G 1
The 362 Radio Valve Co., Ltd. Stoneham Wks., Stoneham Rd., London, E.5.	111	I 3
Thomas & Bishop, Ltd. 37, Tabernacle St., London, E.C.2.	90	H 1
Trade Chronicles, Ltd. 6, Carmelite St., London, E.C.4.	85A	G 2
ULTRA Electric, Ltd. Erskine Road, Chalk Farm, London, N.W.3.	31	C 3
Universal Electric Supply Co., Ltd. 4, Brown St., Manchester.	110	I 3
VARLEY (Oliver Pell Control, Ltd.) 103, Kingsway, London, W.C.2.	77	B 1
Vince's Dry Batteries, Ltd. Garford Wks., Garford St., London, E.14.	74	A 1
WELLWORTH Wireless Co. 8, Withy Grove, Manchester.	84	G 2
Westinghouse Brake & Saxby Signal Co., Ltd. 82, York Rd., King's Cross, London, N.1.	63	B 2
Wharfedale Wireless Works, Ltd. 62, Leeds Rd., Bradford.	101	I 2
Whiteley Electrical Radio Co., Ltd. Victoria St., Mansfield.	62	B 2
Wingrove & Rogers, Ltd. Polar Wks., Old Swan, Liverpool.	51	C 2
Wireless & Gramophone Trader Dorset House, Stamford St., London, S.E.1.	60	A 2
Wireless Retailers' Assoc. of Gt. Britain and N. Ireland. 1, Mitre Court, Fleet St., London, E.C.4.	89	G 1
Wireless World. Dorset House, Stamford St., London, S.E.1.	35	D 3
Wright & Weaire, Ltd. 710, High Rd., London, N.17.	80A	G 3

In Next Week's Issue:—

"The Wireless World"

D.C. Superhet

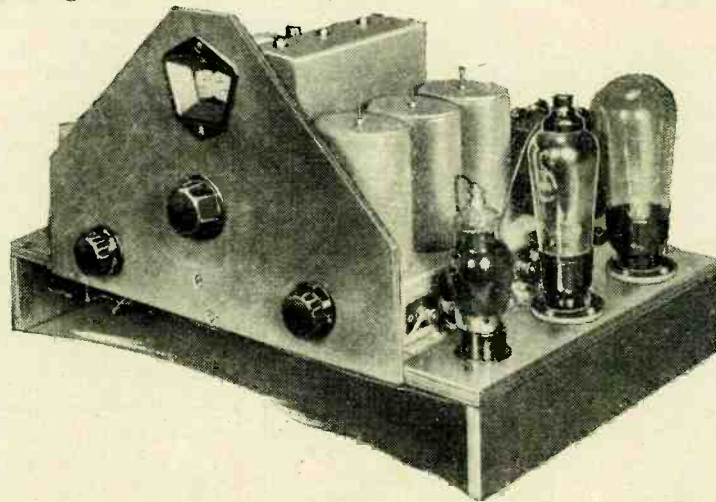
Incorporating A.V.C., Westectors and Pentagrid Frequency Changer

THE new receiver has only four valves, but is capable of a performance equal to, if not surpassing, that of a five- or six-valve set of only a few months ago. The reduction in the number of valves has been made possible by recent valve development and by the introduction of metal rectifiers for signal rectification.

A signal frequency H.F. stage with two tuned preselector circuits for second channel rejection precedes the Pentagrid frequency changer, and the single I.F. stage is coupled by means of iron-core type I.F. transformers. This stage feeds two Westectors, giving signal rectification and delayed A.V.C. on the H.F. frequency changer and I.F. variable-mu valves, and feeds the output pentode through a resistance coupling.

Due largely to this important feature, the A.V.C. system functions unusually well and maintains constant apparent loud speaker volume for large variations in signal input. In addition, the low value of L.F. amplification employed has far-reaching effects on the question of hum. A minimum of smoothing is needed, and yet the hum level is exceptionally low, even with a positive earth, while electrostatic hum pick-up is negligible.

The quality of the reproduction reaches a high level, while the selectivity and sensitivity are adequate for most purposes. The tuning dial is wavelength calibrated, and owing to the use of a special barretter for regulating the heater current of the valves, alterations to the set for different mains voltages between 200 and 250 volts become unnecessary.



New Superheterodyne Circuit Employing Four Valves Only.

Full size blue prints of the wiring connections will be available.

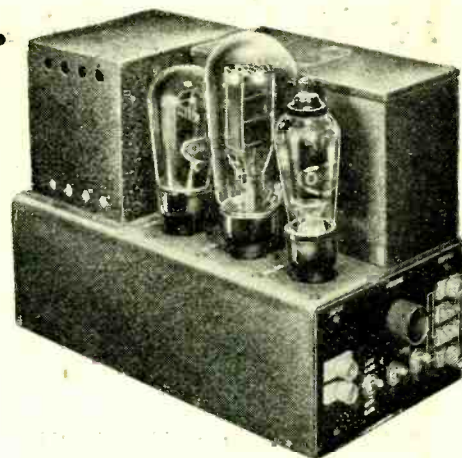
LIST OF PARTS

After the particular make of component used in the original model, suitable alternative products are given in some instances.

- 1 Double-pole single-throw switch Claude Lyons B.A.T.2728 (British Radiophone, Bulgin.)
- 2 Ebonite shrouded terminals, A.E. Belling-Leo Type "B" (Igranic.)
- 2 Westectors Westinghouse W.6
- 1 Resistor, 25 ohms Claude Lyons Type FW.25
- 1 Resistance, 100 ohms 1 1/2 watts Seradex Type M.150
- 1 Resistance, 250 ohms 1 1/2 watts Seradex Type M.150
- 1 Resistance, 20,000 ohms 1 1/2 watts Seradex Type M.150
- 1 Resistance, 0.1 megohm 1 1/2 watts Seradex Type M.150
- 2 Resistances, 0.25 megohms 1 1/2 watts Seradex Type M.150
- 1 Resistance, 0.5 megohm 1 1/2 watts Seradex Type M.150
- 1 Resistance, 1 megohm 1 1/2 watts Seradex Type M.150
- 1 Resistance, 2 megohms 1 1/2 watts Seradex Type M.150
- 2 Resistances, 10,000 ohms 2 1/2 watts Seradex Type G.250 (Dubilier, Eric, Claude Lyons, Varley, Watmel.)
- 1 5-pin plug British Radio Gramophone Co. (Bulgin.)
- 1 Bulb, 6 volts 0.15 amp. Bulgin Type "OB"
- 1 Twin safety fuse holder, with 1 amp. fuses. Belling-Leo Type 1033 (Bulgin.)
- 1 Length Screened Sleeve Harbros
- Plymax baseboard, 10in. x 16in. x 3/4in. Peto-Scott (Overall dimensions of assembled chassis, 16in. length x 10in. width x 9 1/2in. height.)
- 1 Voltage regulator Osram Barretter No. 251 4 oz. No. 20 tinned copper wire, 10 lengths Systo-flex, wire, wood, etc.
- Scrows:—
 - 25 3/4in. No. 4 R/hd. 10 3/4in. No. 4 R/hd.
 - 4 3/4in. No. 4 R/hd. 10 3/4in. No. 4 R/hd.
 - 7 3/4in. No. 4 C/sk. 4 6BA, with nuts and washers.
- Valves:—2 Marconi or Osram VDS. 1 Marconi or Osram DPT. 1 Philco or Claude Lyons 6A7.
- 1 Super R.F. Radiopak, without volume control British Radiophone
- 2 Ferrocart Colverdynes, 110 kc/s Colvern
- 1 Tapered volume control, 0.25 megohm, and knob Claude Lyons Type 250 M-T (Magnum, Rothermel, Varley.)
- 1 Potentiometer, 5,000 ohms Claude Lyons Type P.58 (Haynes Radio, Rothermel, Watmel.)
- 1 Screened H.F. choke Goltone Type SHF (Kinva, Varley, Wearite.)
- 2 Mains H.F. chokes Goltone Type PHF
- 1 L.F. choke Heyberd No. 752 (Davenset, Ferranti, Parmeko, R.L., Sound Sales, Varley, Vortexion.)
- 5 5-pin valve holders Clix Chassis Mounting Type (Preh.)
- 1 7-pin valve holder Philco 27/6005
- 1 Grid clip, for 6A7 valve Philco 4897 (Claude Lyons.)
- 1 Fixed condenser, 4 mfd. 250 v. D.C. working T.C.C. Type 65
- 2 Fixed condensers, 2 mfd. 200v. D.C. working T.C.C. Type 50
- 3 Fixed condensers, tubular, 0.1 mfd. T.C.C. Type 250
- 1 Fixed condenser, 0.01 mfd. Igranic Type FF.12
- 1 Fixed condenser, 0.001 mfd. Igranic Type FF.12
- 1 Fixed condenser, 0.002 mfd. Igranic Type FF.12
- 4 Fixed condensers, 0.0001 mfd. Igranic Type FF.12
- 2 Fixed condensers, 0.0002 mfd. Igranic Type FF.12 (Dubilier, Peak, Telsen.)
- 1 Dry electrolytic condenser, 50 mfd. T.C.C. Type 521 (Dubilier, Telsen.)
- 1 Make-and-break switch Claude Lyons B.A.T.728

G.E.C. Six-watt Power Amplifier

Two-stage A.C.-operated Power Unit in Compact Form



Model B.C.S.1562

THE B.C.S.1562 power amplifier made by the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2, is an A.C.-operated two-stage unit giving a maximum undistorted power output of six watts. An output of this order is sufficient to fill a small- or medium-sized hall, and with suitable disposition of loud speakers will answer for many purposes out of doors, such as at sports meetings, garden fêtes, and the like. Yet on first acquaintance few would include it in the category of public address equipment in view of its exceptionally small size, for the overall dimensions are but 13in. x 6½in. x 10¼in. high. Despite its compactness, there is no undue crowding of the components, nor has the safety factor in a single instance been pared down to the border line to achieve this end; indeed, the components are very generously rated.

in a wireless unit, and, furthermore, enables separate volume controls, or fading devices, to be used where two gramophone turntables or a combination of these and a microphone unit are connected to the amplifier.

Three degrees of tone control are available, but not for compensation of the amplifier's characteristic, which is entirely satisfactory without this artificial aid. They are included in order to meet any particular contingency that may arise in connection with the acoustic properties of the hall or the loud speakers. The high-tension supply is derived from a full-wave rectifying valve (Osram U.14), the output being smoothed by a single choke and the customary array of condensers.

Anode and grid decoupling is applied where necessary, with the result that entire freedom from interstage coupling is achieved, and the amplifier is perfectly stable under all conditions of working.

The only precautions we found necessary, and this applies also to all high gain amplifiers, was to shield the gramophone pick-up leads and earth the outer covering as well as the metal parts of the tone arm.

Good Characteristic

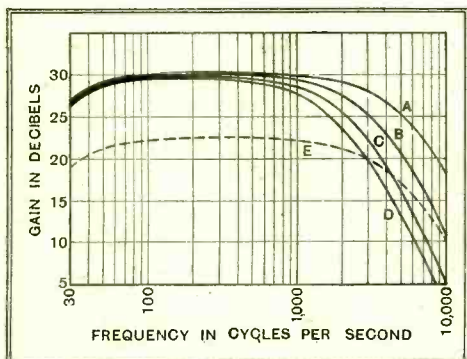
The performance of the amplifier gives no grounds for adverse criticism; gramophone recordings are reproduced faithfully, all of which is in keeping with expectations, having regard to the very satisfactory response curve. A brief explanation of this is necessary, for it may be thought at first that it represents the total gain of the unit. In order to ascertain the overall response, including the output transformer, our measurements were made by joining a 15-ohm non-inductive resistance across the 15-ohm impedance tapping. The decibel scale should

the relative level with the switch in the low gain position.

Curve A is the normal characteristic of the amplifier. For curve B tone control switch No. 1 was depressed; curve C shows the characteristic of the amplifier with the next degree of tone control, while with the full measure available curve D resulted. With the input switch set to "Low Gain" and without tone compensation we obtained the broken line curve, marked E on the graph.

Provision is made to take the necessary operating voltages for a microphone unit from the amplifier. At the back of the chassis is a sunk five-pin valve holder at the filament sockets of which is available a four-volt A.C. supply, while the anode and grid sockets give access to the smoothed D.C. line.

To sum up, the G.E.C. model B.C.S.1562 amplifier satisfactorily fulfils the various functions for which it is intended. It is of sound electrical design without frills or unnecessary complications likely to introduce annoying troubles, and, finally, the workmanship and finish are quite above criticism. Its compactness makes it readily portable and easily stowed away when not in use, and

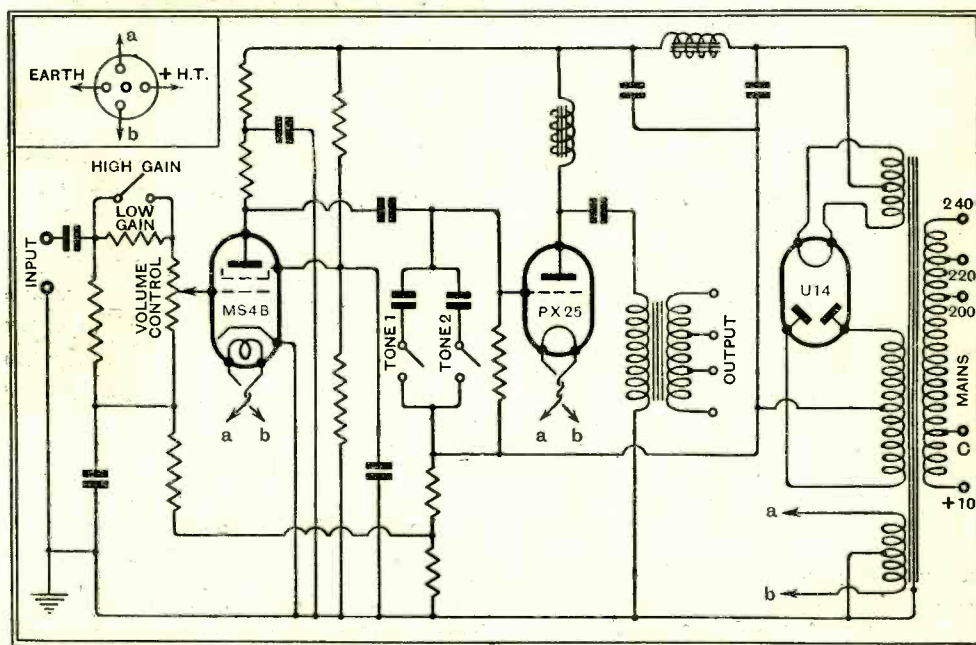


Overall response curves of G.E.C. six-watt amplifier taken across the 15-ohm tapping of output transformer. A, normal characteristic, B, C and D with three degrees of tone control, and E, low gain characteristic.

The circuit employed is quite straightforward, and consists of an Osram MS4B S.G. valve resistance-capacity coupled to a PX25 power valve. The A.C. output from this is fed through a choke-capacity filter to an output transformer having tapings on its secondary winding to give correct matching for loud speakers of 2.5, 5, 7.5, and 15 ohms impedance. Alternatively, if two or more loud speakers are employed the wide choice of output ratios renders it comparatively easy to arrange their connections so that the total impedance of the line amounts to one of these four values. The provision for low impedance transmission lines is a wise one, for with the loud speakers located at a distance little or no loss occurs of the higher frequencies due to capacity effects.

Alternative Input

Control of volume is effected by a 500,000-ohm potentiometer in the grid circuit of the first valve, but, in addition, provision is made to reduce the input to about one-half should the need arise. A switch, marked "High Gain" and "Low Gain," is fitted, and in the former position an input of about 0.22 volt suffices to fully load the amplifier, while 0.56 volt approximately is required under low-gain conditions. A volume control of one-half megohm may seem unduly high, but it allows the amplifier to be employed following the detector valve



Theoretical circuit of G.E.C. B.C.S.1562 six-watt power amplifier.

be used for relative computation of the output only at different frequencies with and without tone compensation. It also shows

at the attractive price of £18 15s., complete with valves, represents very good value for money.

BROADCAST BREVITIES

Time Signals

THE B.B.C. has long been anxious to arrange a fixed schedule for the hours at which the Greenwich time signals are transmitted to avoid the annoyance caused when the "six pips" are superimposed on an interesting programme or when the expected signal is postponed. They hope now to arrange that the time signals in future will always be heard at fixed times, and that they will not interfere with musical or other programmes.

North Regional Dramatic Producer

THE organisation of the staff for the North Regional area proceeds apace. I understand that Mr. Robin Whitworth has been appointed the dramatic producer, working under Mr. E. F. R. Harding, the recently appointed director of programmes.

The Children's Hour

I UNDERSTAND that no decision has yet been made to omit the customary birthday greetings from the Children's Hour, but that the matter is receiving serious consideration. The B.B.C. recognises that the omission may cause acute disappointment to many children, but with the development of the Children's Hour from the informal entertainment of a gathering of "Uncles and Aunts" to its present more serious forty-five minutes, the birthday lists have grown to such a length that it is felt that they now occupy too much of the time and may have to be reluctantly abandoned.

Empire Broadcasting

THE change in the announcements of the different programmes transmitted on the Daventry short-wave sets is merely one of nomenclature. After October 8th the various Empire programmes will be known as No. 1, No. 2, and so on. Thus instead of announcing a programme for "The Canadian Zone," it will in future be known as "Programme No. 5." It has been found that there was so much overlapping of the formal zones that, in practice, the attempt to allot a certain programme to any certain zone was impossible.

Mr. Roger Eckersley's New Title

THE announcement that Mr. Roger Eckersley is now the "Director of Entertainments" only indicates a change in the name of his official post. It was found that some confusion arose occasionally between the respective posts of "Director of Programmes" and "Director of Talks," it was therefore decided to make it clear that the Director of Entertainments and the Director of Talks are two separate and hard-worked individuals, who together are responsible for the entertainment and instructional sides of the programmes.

Transatlantic Relays

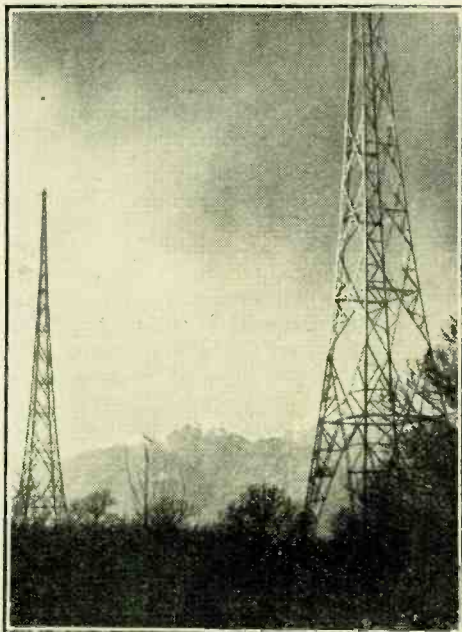
THE interchange of programmes between Europe and America appears likely to receive a fresh impetus from the formation of an International Committee to organise the broadcasting of talks, debates and discussions by prominent speakers in Europe, Asia and America. Dr. Nicholas Butler, president of Columbia University, is chair-

By Our Special Correspondent

man, and the committee includes distinguished representatives from England, and practically all European countries, together with China and Japan. The scheme is under the auspices of the Columbia Broadcasting System, and may be regarded as their answer to the National Broadcasting Company of America, whose interchange of programmes, following the visit of Mr. F. Bate to this country, first brought to public notice the possibilities of transoceanic broadcasting.

Prospective "General Post"

ON the completion of the new National station at Droitwich it is possible that the existing medium wave National transmitters at Brookmans Park, Moorside Edge



SILENT FOR A TIME. The splendidly situated masts of the Italian-speaking station at Monte Ceneri and the studio in Lugano. This station is at present closed down while the transmitters are adjusted to the new wavelength.

and Watchet may become redundant, but in that case it is probable that two of the transmitters will be transferred to the projected North-East of England and North of Scotland Regional stations, while the third may be re-erected at Droitwich as the new Midland Regional transmitter.

The Disgruntled Statesmen

THE recent correspondence between three eminent statesmen and the chairman of the B.B.C. with regard to their non-inclusion in the list of speakers to broadcast forthcoming political addresses has aroused considerable interest. Many listeners, myself included, would welcome the opportunity of hearing addresses by Sir Austen Chamberlain, Mr. Lloyd George and Mr. Winston Churchill, also by Mr. Maxton and many

other prominent politicians, but those in authority at the B.B.C. wisely set a limit to the time allotted to political speeches, fearing that a plethora of such addresses would only weary listeners and thereby defeat their own object. They therefore decided, for the coming season at all events, to limit the speakers to those chosen by the leaders of the three main parliamentary parties. In the good old days when "every little boy or gal . . . was either a little Liberal or else a little Conservative," the task of selection would have been simplified, but now that there are so many shades of political thought it becomes complicated and necessarily leads to some dissatisfaction.

The New Aberdeen Studios

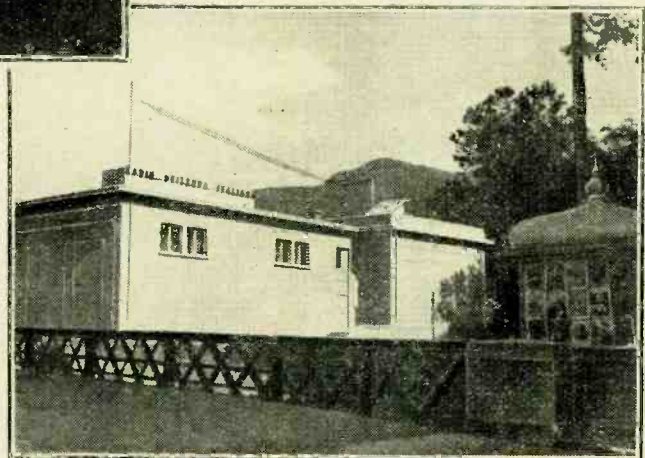
IT is right that Aberdeen, the home-town of Scotland's New Regional Director, Mr. Dinwiddie, should be equipped with the most up-to-date studios, but I must confess to surprise when I dropped in at the newly designed studios in Belmont Street last week.

Broadcasting House in Miniature

There will be a Press view soon, and meantime those in authority have decreed that no detailed account must appear, so I am debarred from describing the new talks studio, rigged up with the now familiar "traffic signal" system of lights for communicating between the control engineer and the speaker, of the twin gramophone turntables and the modernistic fittings and furniture, the whole giving the appearance of having been lifted lock, stock, and barrel from Broadcasting House, London, while the concert studio will certainly be Scotland's finest.

Mr. Dinwiddie's Slogan

I can, however, say this: Mr. Dinwiddie



is already on the warpath with the slogan, "A fair chance for every town in Scotland," and the probability is that broadcasting studios will be erected in other Scottish centres, and a start can be expected in the region of Inverness.

"The White Château" Again

LISTENERS will welcome the opportunity of again hearing that popular broadcast play, "The White Château," which will be revived on October 9th and 10th with incidental music specially composed by Norman O'Neill.

Practical HINTS and TIPS

SO far as the "one H.F." receiver is concerned, it is generally best to carry out the operation of adjusting the trimming condensers while the reaction control is advanced towards its limit. Although the best form of reaction control does not introduce

Reaction and Ganging.

much change in tuning, there is always the possibility of some slight disturbance being introduced, and so it is desirable that the circuits should be in most accurate alignment when the set is in the most sensitive condition—that is, with reaction fully advanced.

IN the "Hints and Tips" section of *The Wireless World* of September 1st a note was published on the advantages of inserting an anti-interference filter in the mains supply leads at the point where they enter the building. The purpose of

Filtering and Electrical Supply.

such a filter is, of course, to dispose of interference of a high-frequency nature, which may have been superimposed on the mains current by electrical machinery, etc., connected to the same mains supply system, but perhaps at a considerable distance.

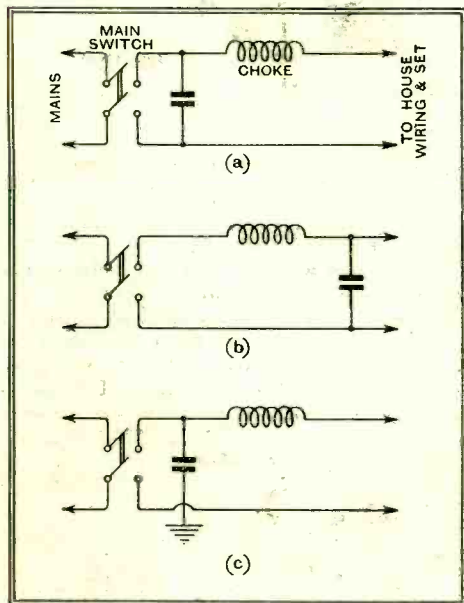


Fig. 1.—Simplified mains filters with a single choke.

As a footnote to what has already been said on the subject, it should perhaps be pointed out that in some cases the filter may be simplified and cheapened by using a single choke instead of a pair of chokes. It is therefore suggested that one or other of the arrangements shown in Fig. 1 should be tried, if only for the reason that the use of a single choke introduces less loss of voltage; looked on in another way,

AIDS TO BETTER RECEPTION

it becomes less important to use a choke of extremely low D.C. resistance.

Referring to the diagram, it will be seen that the various arrangements suggested differ only with regard to the position of the by-pass condenser. In circuits (a) and (b) this condenser is respectively connected on the "input" and "output" sides of the filter, while in diagram (c) one side of it is connected directly to earth. It can only be determined by trial which arrangement will give best results, and, above all, it must be remembered that it will depend on circumstances in which mains lead the choke should be inserted.

THE practice of fitting some form of tone control whereby heterodyne interference may be minimised by reducing the high-note response of the receiver is now fairly common. Unfortunately, most of the methods adopted are some-

The Best Whistle Suppressor.

what crude and extremely drastic in their action. True, many of them are effective enough in suppressing certain forms of interference from stations working in adjacent channels, but music is quite lifeless, and speech has lost much of its intelligibility.

This is mainly due to the fact that the filters fitted have a "tailing characteristic"; they begin to attenuate at frequencies of the order of 2,000 cycles per second to an appreciable extent. The heterodyne whistle between adjacent stations, if it is worth while trying to remove it, is of considerably higher frequency than this, and it is not hard to see that the ideal arrangement should only come into operation at a suitably chosen point in the spectrum (actually about 3,500 kc/s), leaving the upper middle register at full strength.

In the New Monodial receiver a scientifically designed low-pass filter of this nature is fitted and is so arranged that it may be thrown into circuit when heterodyne interference is present. At other times full advantage is taken of the wide frequency response of the receiver.

To hear a filter of this type in operation is a revelation of what can be done. With the receiver tuned to a station suffering from interference, and while the filter is out of operation, one hears a distressing background of whistle, mixed with side-band "splash," which may be so bad that the transmission has no entertainment value. Then, at a turn of the switch, the interference disappears as if the unwanted station had suddenly shut down.

The purpose of this note is to point out that the same type of low-pass filter is

also applicable to other receivers, more especially to those which have an intermediate L.F. stage. The main requirements are that the filter should work with input and output impedances of roughly 10,000 ohms; this means that the preceding valve and the succeeding coupling device should have roughly that impedance value. If transformer coupling be employed, it will be necessary to reduce impedance artificially by shunting the primary with a 10,000-ohm resistance.

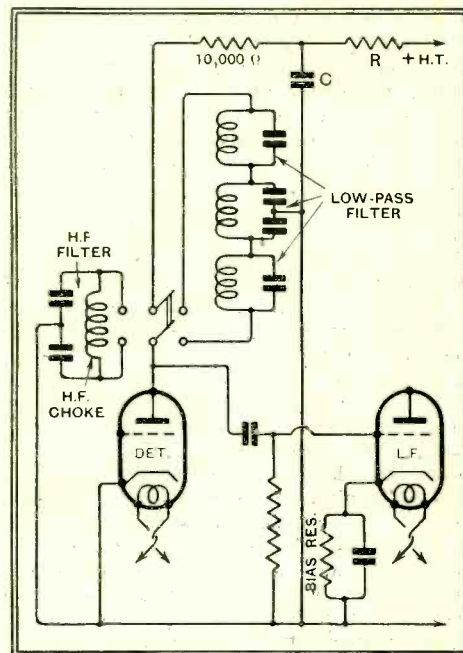


Fig. 2.—An advanced type of heterodyne whistle filter which may be thrown into circuit at will. The ordinary decoupling components are marked R. and C.

The connections of the low-pass filter unit are shown in Fig. 2. With the switch in the right-hand position the filter is in circuit, while in the other position the ordinary H.F. stopping devices become operative.

LOW-FREQUENCY transformer ratio is often a matter of considerable importance, especially in view of the fact that, in most modern sets, the detector is arranged to feed directly into the output valve without an intermediate L.F. stage.

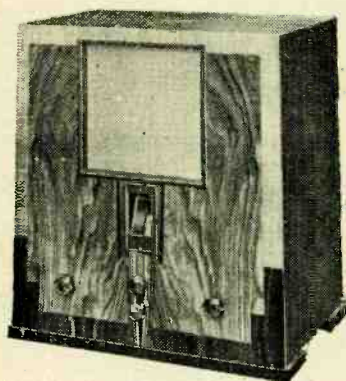
An Important Link.

It is seldom that the typical grid detector provides a large surplus of undistorted output, and so the result of using an insufficiently high step-up ratio is likely to be serious.

It should be remembered that the detector output required for loading the output stage is directly proportional to the voltage-step-up provided by the transformer. If, for example, a ratio of 1:2.5 were employed in a set where 1:5 was specified, twice the detector output would be needed for correct operation.

H.M.V. "Superhet Concert Seven"

MODEL 467



FEATURES. *Type.*—Seven-stage table-model super-heterodyne receiver with automatic volume control. Moving-coil loud speaker and provision for pick-up and external loud speaker. *Circuit.*—Signal frequency H.F.—oscillator—first detector—I.F. amplifier—metal oxide second detector—first L.F. with tone control—triode output valve. Full-wave valve rectifier. *Controls.*—(1) Main tuning with optically magnified illuminated drum dial. (2) Volume control and "Static Suppressor." (3) Duplex tone control. (5) Waverange, gramophone and on-off switch. *Price.*—22 gns. *Makers.*—The Gramophone Co., Ltd., 98-108, Clerkenwell Road, London, E.C.1.

A Receiver of High Performance on All Points

THE specification of this table-model receiver, having regard to its compact design, is remarkably full, and the numerous detail refinements in the circuits and controls indicate that no pains have been spared to secure the highest possible performance under modern receiving conditions. The cabinet is very similar in size and general design to that of the Model 438 reviewed in our issue of June 16th, 1933, but instead of dual vertical tuning scales there is a single illuminated drum dial which is viewed through a magnifying glass prism.

There are seven valves and seven stages in the circuit, excluding the power rectifier, the reason being that a metal oxide rectifier is used in the second detector stage. Selectivity at signal frequency is provided by the first stage, which is preceded by a band-pass tuner. Separated valves are employed for the oscillator and first detector, and two band-pass filters tuned to 117 kc/s are associated with the single I.F. stage. The metal oxide second detector is tapped across a portion of the secondary of the output I.F. transformer, while a second metal oxide rectifier for automatic volume control derives its input from the primary winding. Both the first H.F. valve and the first detector are controlled, and a delay voltage is supplied by a potential divider resistance across the H.T. supply.

In addition to the A.V.C. bias on the first valve there is a variable cathode bias resistor which is fitted at the back of the chassis, and may be pre-set to give a volume level suited to local conditions of background noise. The full magnification of the set is obtained at any time by pushing inwards the main volume control spindle. This actuates a shorting switch connected across

the "Static Suppressor" control resistance.

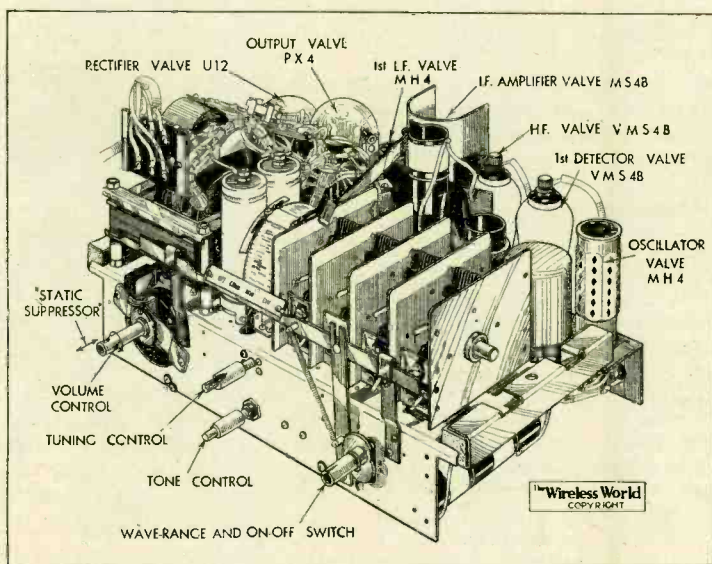
The manual volume control follows the second detector and functions both on radio and gramophone. There are two L.F. stages—both triodes—the output valve giving 2½ watts undistorted. The coupling between these stages is of the parallel-fed transformer type, and incorporates a tone control circuit which is worthy of the name. It controls both high- and low-note response, and is operated by two variable resistances coupled together. There is a mid-position which can be felt by a notch in the control, and movement to the left increases the low and to the right the high notes.

The power transformer is of unusually generous proportions, and is protected by a fuse in the centre connection to the H.T. winding and a "heat coil" in series with the primary winding. The latter is a special type of thermally delayed fuse which breaks down for steady currents in excess of 0.6 amp., but stands up to brief surges which may occur while the set is warming up.

The range is all that might be expected

from seven stages, and there is an ample reserve of magnification for use when conditions permit. There is not the least doubt that this set will receive any station above the prevailing noise level, and will do so, moreover, without calling for special skill on the part of the operator. At no time during the course of our tests did we find it necessary to make anything like full use of the overall amplification of which the set is capable.

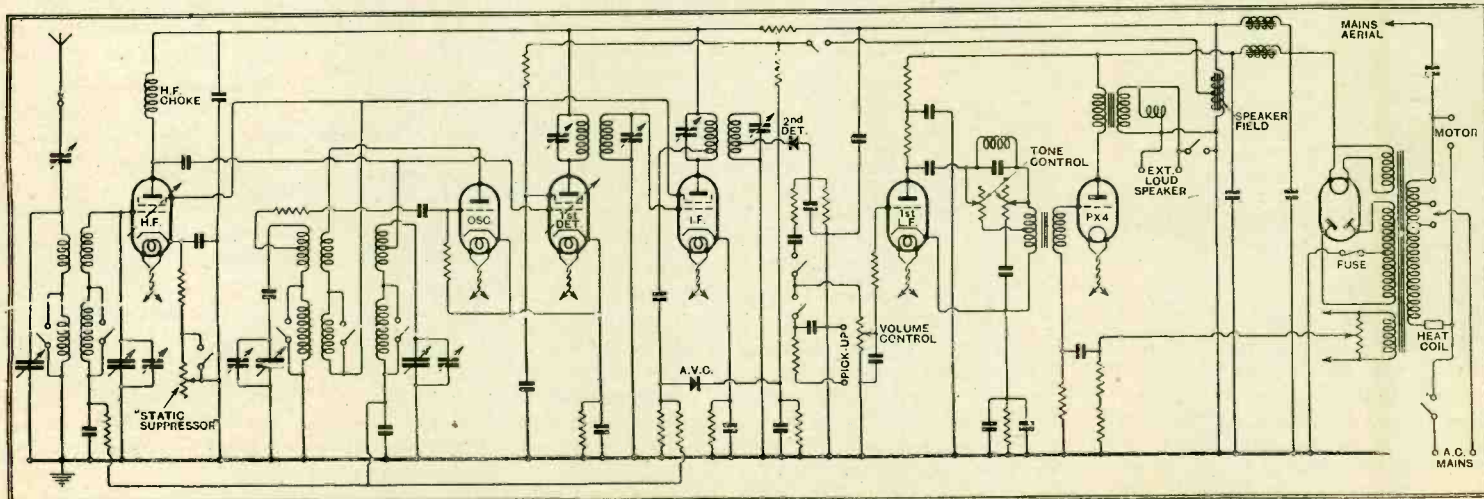
The makers claim adjacent channel selectivity, and in Central London on a 50ft. outdoor aerial the set could be tuned to Mühlacker without any trace of modulation interference from London Regional. Few receivers we have tested have equalled this performance in the matter of selec-



For a seven-stage circuit the chassis is remarkably compact.

tivity. On long waves the range and selectivity are equally good.

The high selectivity has not been gained at the expense of quality, however, and the tonal balance with the set properly tuned and the tone control in the mid-position is, in our opinion, just right when listening to the B.B.C. stations. The move-



Schematic circuit diagram. Separate metal oxide rectifiers are used for final detection and A.V.C.

H.M.V. "Superhet Concert Seven"

ment of the silk covering the loud speaker fret affords proof of the amplitudes which are developed in the bass, but the set is free from the slight over-emphasis of low tones which we have noticed in some earlier H.M.V. sets. One's personal predilections in the matter of quality are easily satisfied by the tone control, which is one of the most satisfactory we have so far handled.

A careful search of the medium waveband failed to reveal any whistles due to second channel interference, and as no special circuits have been included to suppress these

the success achieved must be attributed to the high selectivity at signal frequency.

It is indicative of the satisfactory working of the A.V.C. that with the manual volume control once set for the local station no further adjustment is required when turning to the principal European stations.

Next Week's Set Review:**PHILIPS 634A
SUPERINDUCTANCE RECEIVER**

LABORATORY TESTS

A Review of Manufacturers' New Products

PENTAGRID VALVES

A NUMBER of American Pentagrid valves, intended for use as combined oscillator and first detector valves for superheterodyne frequency changing purposes, has been submitted for test. The valves are listed as the 6A7 type, and have a heater rated to consume 0.3 ampere at 6.3 volts; they are designed expressly for use in car radio sets where the 6-volts accumulator may rise to a considerably higher voltage when on charge, hence the peculiar voltage rating. It is stated by the makers that considerable latitude in the heater potential is permissible.

The valve is of the indirectly heated type, and contains five grids and an anode. The two inner grids form the control grid and anode of the oscillator, while the next is a screen grid arranged to screen the oscillator electrodes from the others. The remaining electrodes form the control grid, screen grid, and anode of a variable-mu tetrode which is used as the first detector. No external mixing circuit is required, and the oscillator coupling is obtained internally through electronic action.

On test, the valve gave an entirely satisfactory performance, and proved superior from every point of view to the conventional two-valve frequency changer.

Although the valve is primarily intended for battery operation in a car set, it can also be used in a D.C. mains set, and tests indicated that it would give a satisfactory performance when used in this manner. It may also be operated from A.C.

Another Pentagrid with similar characteristics, the 2A7, but with a heater rated to consume 0.8 ampere at 2.5 volts is available, and this is suitable for use in the New Mono-



6A7 Pentagrid with a heater rated at 6.3 volts 0.3 ampere.

dial Super. The makers are the Philco Radio and Television Corp. of Great Britain, Ltd., Aintree Road, Perivale, and the price is 16s.

W.B. TYPE PM4A SPEAKER

AS in most of the W.B. range of loud speaker units this year, the model tested was fitted with the "Microlode" output transformer and switching device. There are two switch arms controlling tappings on



W.B. type PM4A permanent magnet loud speaker incorporating the "Microlode" matching device.

both primary and secondary of the transformer, and a choice of seventeen ratios is available for single output valves and four

ratios for push-pull stages requiring a centre tap. The change, both in volume and quality, on varying the step-down ratio is most marked, and the load can be rapidly adjusted to give the best results.

Tested with the load adjusted to the calculated value, the efficiency was found to be exceptionally good for a permanent-magnet unit. Above 100 cycles it was equal to that of our standard 10in. energised unit.

The PM4A is also remarkable for the excellent response at the extreme top. Between 7,000 and 9,000 cycles it has a better output than any small commercial unit so far tested. There is a small resonance at 4,500 cycles, a more pronounced one at 2,500 cycles, and the bass resonance occurs at 130 cycles, below which the output falls steadily to a cut off at about 75 cycles.

The price of the new PM4A, which is made by Whiteley Electrical Radio Co., Ltd., Victoria Street, Mansfield, Notts, is 42s.

GOLTONE H.F. CHOKES

THE type P.H.F. heavy-duty H.F. choke has been designed especially for use in circuits passing currents of a greater magnitude than can be dealt with safely by the normal H.F. choke. It is particularly suitable for including in the heater supply circuits of a D.C. mains receiver and for certain types of interference suppressor devices where the current flowing does not exceed 0.35 amp.

Measured at a frequency of 1,000 c/s its inductance was 10,000 microhenrys approximately, yet its D.C. resistance is only 17.6 ohms. The choke is wound on a 10-section former and measures 4½in. high, the base being 2½in. x 1¼in. overall, and the price is 7s. 6d.

The standard model for use in H.T. smoothing circuits is made in two styles: the type S.H.F. and the type S.S.H.F.

Goltone heavy-duty and screened-type H.F. chokes.



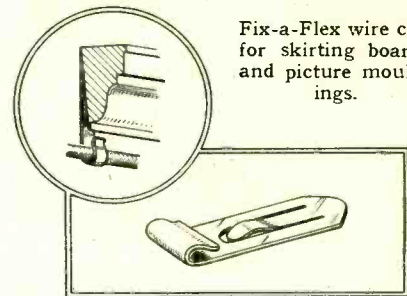
Both models are screened, the principal difference being that the type S.S.H.F. is provided with a screened lead for joining to the anode terminal of S.G. valves. The specimen tested showed an inductance of approximately 200,000 microhenrys at a frequency of 1,000 c/s, its D.C. resistance being 490 ohms. This choke will carry up to 50 mA. with safety, and the price is 4s. 6d.

The makers are Ward and Goldstone, Ltd., Frederick Road (Pendleton), Salford 6, Lancs.

FIX-A-FLEX WIRE CLIP

AN ingenious clip for fixing flexible wires such as loud speaker extensions, earth lead, etc., to skirting boards, picture mouldings and other woodwork in the room, has been introduced by N. Johnson, Fix-a-Flex Works, 35a, South Park Road, Wimbledon, London, S.W.19.

It consists of a stout brass strip, bent at one end into a loop for the wire, the other being slightly pointed and having a tongue-piece stamped out. It is fixed in position by inserting the pointed end between the woodwork and the wall; if the gap between these is too wide to afford a secure grip the tongue-piece can be opened out until a secure fixing is obtained.

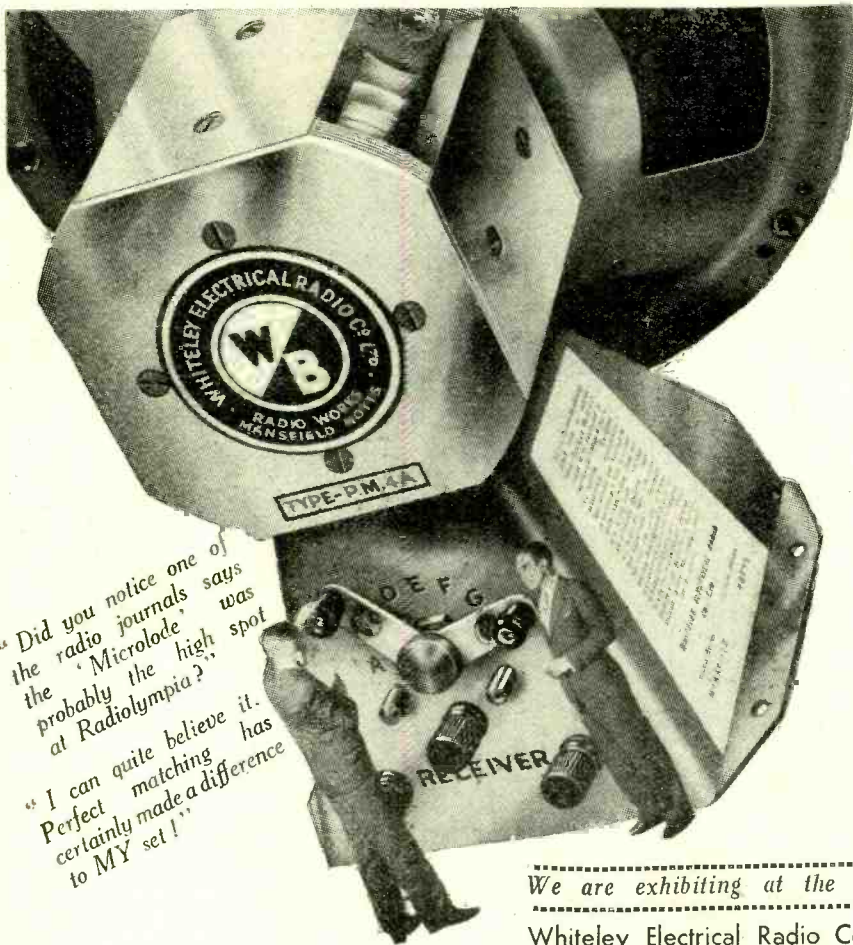


Fix-a-Flex wire clip for skirting boards and picture mouldings.

They are distributed through Houghton (Ensign, Ltd.), High Holborn, London, W.C.1, and cost 1s. 6d. a box containing one dozen.

WHARFEDALE LOUD SPEAKERS

IN connection with our review of these units on page 220 of our September 8th issue, we are asked by the makers to state that the price of the "Golden" model has now been reduced from 63s. to 55s.



"Did you notice one of the radio journals says the 'Microloode' was probably the high spot at Radiolympia?"
 "I can quite believe it. Perfect matching has certainly made a difference to MY set!"

**ACCURATE
MATCHING
AT LAST!**



● 17 transformer ratios for really accurate matching to ANY power valve or pentode and 4 ratios for Class B or QPP *all available on one speaker* by a simple switch adjustment!
 ● Added sensitivity due to the 'Mansfield' magnetic system! Better balance through really accurate matching! The difference in performance must be heard to be believed.

'MICROLOODE'

(Regd. Trade Mark)

Type PM4a - 42/- Type PM6 - 32/6
MOVING-COIL SPEAKERS'
 With the new Microloode feature and the famous 'MANSFIELD' magnetic system.

Write for the MICROLOODE folder.

We are exhibiting at the Manchester Radio Exhibition Sept. 27 to Oct. 7.

Whiteley Electrical Radio Co. Ltd., Dept. W, Radio Works, Mansfield, Notts.



SEND FOR
NEW POLAR
CATALOGUE

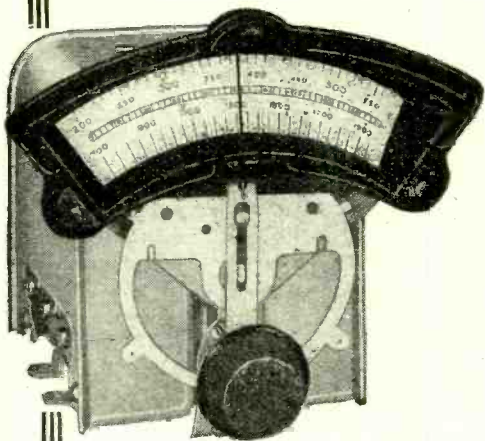
POLAR

for **SOUND DESIGN!**

FAMOUS
SINCE
1922

HIGHEST quality workmanship, accuracy and dependability have contributed to the unique position Polar hold to-day. The ever-increasing popularity has been further enhanced by the recent additions to the Polar Range.

≡ POLAR FULL-VISION & MOVING SCALE DRIVES ≡

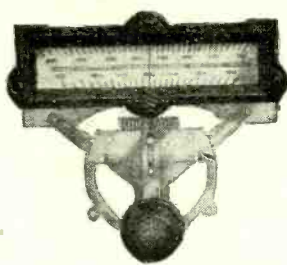


POLAR STAR MINOR THREE FOUR AND SUPER HET TYPES

Steel frame with cover. Trimmers operated from top. Sections matched within 1/2 per cent. or 1 mmfd. (whichever is the greater).

3x'0005 and Superhet - - - - 18/9
 4x'0005 and Superhet - - - - 25/-

With full-vision "arcuate" (as shown), "horizontal" or "semi-circular" drive, 5/9 extra, and for a further 2/- the drive can be fitted with air dielectric trimmer as "Uniknob" design.

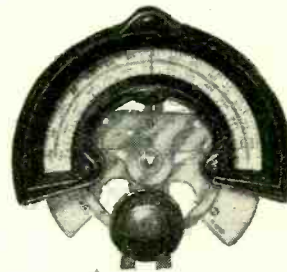


POLAR FULL-VISION "HORIZONTAL" DRIVE

Slow-motion drive. Scale in wavelengths and 0-100 degrees. Moulded escutcheon. Lampholder. Price

5/9

Fitted with air dielectric trimmer, as "Uniknob" design, 7/9.

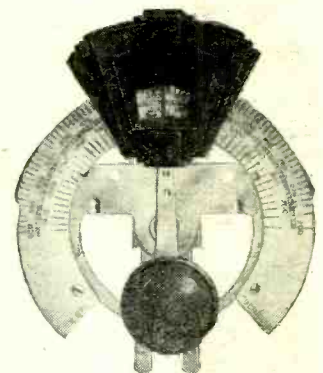


POLAR "SEMI-CIRCULAR" DRIVE.

Slow-motion drive. Bevelled scale in wavelengths and 0-180 degrees. Moulded escutcheon. Lampholder. Price

5/9

Fitted with air dielectric trimmer, as "Uniknob" design, 7/9.



POLAR "MOVING-SCALE" DRIVE

Slow-motion drive. Bevelled scale in wavelengths and degrees 0-180. Moulded escutcheon. Lampholder.

4/6

Fitted with air-dielectric trimmer, as "Uniknob" design, 6/6.

WINGROVE & ROGERS, LTD.

188-9, STRAND, LONDON, W.C.2.

Phone: Temple Bar 2244/5/6. Polar Works: Old Swan, Liverpool.

♡ 2564

MISCELLANEOUS ADVERTISEMENTS

NOTICES.

THE CHARGE FOR ADVERTISEMENTS in these columns is 12 words or less, 3/- and 3d. for every additional word.

Each paragraph is charged separately and name and address must be counted.

SERIES DISCOUNTS are allowed to Trade Advertisers as follows on orders for consecutive insertions, provided a contract is placed in advance, and in the absence of fresh instructions the entire "copy" is repeated from the previous issue: 13 consecutive insertions 5%; 26 consecutive, 10%; 52 consecutive, 15%.

ADVERTISEMENTS for these columns are accepted up to **FIRST POST ON MONDAY MORNING** (previous to date of issue) at the Head Offices of "The Wireless World," Dorset House, Stamford Street, London, S.E.1, or on **SATURDAY MORNING** at the Branch Offices, 19, Hertford Street, Coventry; Guildhall Buildings, Navigation Street, Birmingham, 2; 280, Deansgate, Manchester, 3; 280, Renfield Street, Glasgow, C.2.

Advertisements that arrive too late for a particular issue will automatically be inserted in the following issue unless accompanied by instructions to the contrary. All advertisements in this section must be strictly prepaid.

The proprietors retain the right to refuse or withdraw advertisements at their discretion.

Postal Orders and Cheques sent in payment for advertisements should be made payable to **ILIFFE & SONS LTD.**, and crossed **& Co.** Notes being untraceable if lost in transit should not be sent as remittances.

All letters relating to advertisements should quote the number which is printed at the end of each advertisement and the date of the issue in which it appeared.

The proprietors are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

NUMBERED ADDRESSES.

For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. When this is desired, the sum of 6d. to defray the cost of registration and to cover postage on replies must be added to the advertisement charge, which must include the words Box 000, c/o "The Wireless World." All replies should be addressed to the Box number shown in the advertisement, c/o "The Wireless World," Dorset House, Stamford Street, London, S.E.1. Readers who reply to Box No. advertisements are warned against sending remittance through the post except in registered envelopes; in all such cases the use of the Deposit System is recommended, and the envelope should be clearly marked "Deposit Department."

DEPOSIT SYSTEM.

Readers who hesitate to send money to advertisers in these columns may deal in perfect safety by availing themselves of our Deposit System. If the money be deposited with "The Wireless World," both parties are advised of its receipt.

The time allowed for decision is three days, counting from receipt of goods, after which period, if buyer decides not to retain goods, they must be returned to sender. If a sale is effected, buyer instructs us to remit amount to seller, but if not, seller instructs us to return amount to depositor. Carriage is paid by the buyer, but in the event of no sale, and subject to there being no different arrangement between buyer and seller, each pays carriage one way. The seller takes the risk of loss or damage in transit, for which we take no responsibility. For all transactions up to £10, a deposit fee of 1/- is charged; on transactions over £10 and under £50, the fee is 2/6; over £50, 5/-. All deposit matters are dealt with at Dorset House, Stamford Street, London, S.E.1. and cheques and money orders should be made payable to Iliffe & Sons Limited.

SPECIAL NOTE.—Readers who reply to advertisements and receive no answer to their enquiries are requested to regard the silence as an indication that the goods advertised have already been disposed of. Advertisers often receive so many enquiries that it is quite impossible to reply to each one by post. When sending remittances direct to an advertiser, stamp for return should also be included for use in the event of the application proving unsuccessful.

PILOT AUTHOR KITS

Exact to Specification

Peto-Scott are pioneers in Radio and Television. Our service to the British public was introduced in 1919, and during fourteen years of Solid Service and Satisfaction we have established a reputation for fair delivery that defies competition. Sets, Kits of all descriptions, Part Kits, Miscellaneous Components, Speakers, Eliminators, and Accessories. Purchases can be made for Cash, C.O.D., or on Easy Payments. Send list of your requirements for quotation by return.

NEW MONODIAL

RECEIVER KIT

Author's Kit of FIRST SPECIFIED PARTS for RECEIVER PORTION ONLY, less Plymax Chassis, Panel, Cabinet and Valves
 Cash or C.O.D. **£10-19-6**
 Carriage Paid
 Extra for Peto-Scott Plymax Chassis as used by the Author, 14" x 12" x 3". Ready Drilled and Assembled with Runners ... 10 6
 Peto-Scott Oak faced Ply Panel, Ready Drilled, 14" x 10" ... 2 6

RECEIVER KIT "A" as above but with PETO-SCOTT READY-DRILLED AND ASSEMBLED PLYMAX CHASSIS WITH RUNNERS AND PANEL, less Valves and Cabinet. Cash or C.O.D., Carriage Paid, £11-12-0 or Deposit £1-12-0. Balance in 11 monthly payments of 20/-.

POWER UNIT KIT

Author's Kit of FIRST SPECIFIED PARTS for POWER UNIT ONLY but less Plymax Chassis and Valves
 Cash or C.O.D. **£8-13-6**
 Carriage Paid
 Extra for Peto-Scott Ready-Drilled Plymax Chassis with Runners, 18" x 6 1/2" x 3" ... 7 6
POWER UNIT KIT as above but with READY-DRILLED AND ASSEMBLED PLYMAX CHASSIS, Cash or C.O.D., Carriage Paid, £9-0-0 or 12 monthly payments of 16/6.

BUILD your "Wireless World" Set on the PETO-SCOTT PLYMAX CHASSIS used and specified by the "Wireless World."

COMBINED KIT

Comprising Receiver and Power Unit Kits with 2 Peto-Scott Ready-drilled Plymax Chassis with Runners and Peto-Scott Ready-drilled Oak Panel, less Valves and Cabinet. Cash or C.O.D. Carriage Paid **£20-12-0** or £3-12-0 Deposit and 11 monthly payments of 35/-.

COMPLETE KIT

Comprising Receiver and Power Unit Kits as Combined Kit but with Valves, less Cabinet. Cash **£27-17-0** or C.O.D. Carriage Paid ... or £5-17-0 Deposit. Balance in 11 monthly payments of £2-4-0.

FINISHED INSTRUMENTS

Peto-Scott supply all "Wireless World" Sets as finished receivers, Aerial tested. Cash, C.O.D. or H.P. Send for quotation, no obligation. Peto-Scott have specialised in "Wireless World" Kits and finished instruments for 14 years.

MODERN BATTERY FOUR

KIT 'A' Author's Kit of FIRST SPECIFIED COMPONENTS including ready-drilled ply-panel and Peto-Scott assembled and drilled PLYMAX CHASSIS, excluding Valves, Cabinet and Speaker. Cash or C.O.D. **£8-6-9** or 12 monthly payments of 15/3.

PETO-SCOTT PLYMAX CHASSIS SOLELY SPECIFIED. Plymax Chassis as specified by the Author, drilled and assembled, 10" x 10". Cash or C.O.D. Post **7/6** and Packing 1/3 extra.

IMMEDIATE DELIVERY CASH - C.O.D. - H.P.

PETO-SCOTT CO. LTD.
 77, CITY ROAD, LONDON, E.C.1.
 West End Showrooms: 62, High Holborn, London, W.C.1

RECEIVERS FOR SALE.

WEBSTER Amplifier, A.C., 8 watts undistorted output, complete 6 valves; £10.—Smallridge, 38, Farnham Rd., Guildford. [3513]
"W.W." Single Dial Super (battery), including valves; £3/10.—Steele, 38, Burleigh Rd., West Southbourne, Bournemouth. [3520]
GAMBRELL Halford 7 tube A.C. Superhet. Chassis, valves, speaker; cost £28, accept £14.—15, Balfour Rd., W.3. Acorn 1212. [3510]
8 Guineas.—Ethatrope 200-240 A.C., 2 S.G. det. and pentode, automatic tuning, in walnut cabinet, with valves and moving coil speaker; listed 23 guineas, unopened; c.o.d., carriage paid.—Kay, 167, City Rd., London, E.C.1. [3506]
ARMSTRONG—Latest Universal A.C. D.C. chassis, specially efficient S.G. circuit, Pentode output, incorporating gramophone amplifier, splendid reproduction, fully guaranteed, 75/-; with 5 valves, 114/-; approval.—Armstrong Co., 100, King's Rd., N.W.1. [3517]

ACCUMULATORS—BATTERIES.

MATERIALS.—Cans, 15/-; carbons, 5/9; muslins, 1/6 1,000.—Batteries, 310, Markhouse, Walthamstow. [3524]

MAINS EQUIPMENT

N.P. Battery Chargers for A.C. Mains; trade list free; special offer for 7 days only.
N.P. Have a Few Slightly Soiled Instruments; bargains; list; from 35/- to £15.
N.P.—Trade lists make a very special offer in prices for 7 days only.
N.P.—30 volts variable 1/2 to 2 amps., will charge up to 30x2 volt batteries at once; cost 3d. in current.
N.P. Have 3 Circuit Chargers that Will Do Up to 120x2 volt batteries for 2/6 cost; for £7/12/6; offer open for 7 days only.
N.P.—Send full list with photographs of battery chargers, 2 years' guarantee; lowest price on market.—Nash Products, Ltd., Stechford, Birmingham, 9. [3508]

HOYNE'S Transformers and Chokes the Best Obtainable. perfect insulation, regulation and reliability.
HOYNE'S Transformers used by many well-known set manufacturers after testing all others.
HOYNE'S Transformers fitted with tapped and screened primaries, filaments all centre tapped, stout cast aluminium clamps and clearly marked terminal strips are fitted to all models.
HOYNE'S Components are guaranteed for one year; built to your own specification at very competitive prices.
HOYNE'S Components.—The components you will eventually use, start right; a dud cannot pass the Hoyne test.
HOYNE'S New Monodial Super, aluminium chassis, drilled for components, complete with Power Transformer, two chokes, push-pull intervalve transformer and valve holders 51/-, carriage paid.
HOYNE'S New Monodial Transformer, 425-0-425v, 120 m.a., 4v. 3a, 4v. 1a., 4v. 1a., 4v. 6a., 24/-, post 1/3; weight 10lb. 10 henry choke, 6/-, post 6d.; 20 henry choke, 7/6, post 6d.
HOYNE'S—250-0-250v. 60 m.a., 4v. 1-2a., 4v. 2-4a., 10/-, post 9d.; with extra 4v. 1-2a. winding, 12/6, post 1/-.

(This advertisement continued in third column.)

Mains Equipment.—Contd.

(This advertisement continued from first column.)

HOYNE'S Ferrocart Model.—350-0-350v. 60-70 m.a., 4v. 2-3a., 4v. 2-4a., 12/6, post 1/-; with extra 4v. 1-2a. winding, 13/6, post 1/-.
HOYNE'S—350-0-350v. 120 m.a., 4v. 2-3a., 4v. 4-6a., 4v. 1a., 4v. 1a., 16/-, post 1/3.
HOYNE'S—500-450-0-450-500v. 140 m.a., 4v. 2-4a., 4v. 4-6a., 4v. 2a., 4v. 2a., 27/6, post 1/3; weight 11lb.
HOYNE'S—0-110-135v. 90 m.a., suitable for H.T. 6 or 7, 7/6, post 9d.; with 4v. 2-4a. winding, 9/6, post 9d.
HOYNE'S—200v. 200 m.a., 4v. 2-4a., 4v. 1-2a., for H.T. 8, 13/6, post 1/-.
HOYNE'S—Auto Transformers, Chokes and Filament Transformers always in stock.
HOYNE'S Components still have no equal.
M. J. HOYNE, Offices and Works, 8a7, Gladstone Rd., Wimbledon, S.W.19. Tel.: Liberty 3303. [3455]
VORTEXION, Wimbledon, for 99.9% reliable transformers.
If You Haven't Tried Them Yet Ask Someone who has, or call and inspect complimentary letters.
All Standard Models Delivery by Return; all secondaries centre tapped.
GUARANTEED 12 Months, and within 5% normal and 2 1/2% super models, neat shrouding, with detachable feet, as used by Government Departments, etc., etc.
VORTEXION—New monodial transformer, 200-250, 50 cycles, 425-0-425, 120 m.a., 4v. C.T. 3a., 4v. C.T. 1a., 4v. C.T. 1a., 4v. C.T. 6a., screen primary, open type, 20/-; shrouded, 22/-; super shrouded, 26/-; 10 henry choke, 5/6; 20 henry choke, 8/6.
VORTEXION—Ferrocart 111, 350-0-350, 60 m.a., 4v. 2-3a., C.T., 4v. 3.5, C.T.; open type 13/6, shrouded 16/-; post 9d.
VORTEXION—250-0-250, 4v. 1 to 2a., 4v. 2 to 4a.; open type 10/6, shrouded 12/6; post 9d.
VORTEXION—Super model for H.T. 8 or 9 or 10, 4v. 1 to 2, 4v. 2 to 4; open type 14/6, shrouded 16/6; post 1/-.
VORTEXION—2 1/2-watt Monodial A.V.C. model; open type 14/6, shrouded 16/6; post 1/-.
VORTEXION—5-watt Monodial A.V.C. model, 400-0-400, 120 m.a., 4v. 6a., 4v. 3 1/2a., 4v. 2, 4v. 1a., super screened; 20/-, shrouded 24/-.
VORTEXION—350-0-350, 120 m.a., 4v. 2 to 5a., 4v. 2 to 4a., 4v. 2.5a.; open type 14/6, shrouded 16/6.
VORTEXION—400 or 450 or 500v., 120 m.a., 4v. 2 to 5, 4v. 2 to 5, 4v. 2 to 5; open type 15/-, shrouded 23/-.
VORTEXION—400 or 450 or 500, 150 m.a., 4v. 4a., 4v. 2.5, 4v. 2, 4v. 2, 4v. 2, core size 2 1/4 in. x 1 1/4 in., a superb job. 2% regulation; 35/- shrouded with terminals, less terminals, 30/-, open type 26/-; post 1/3.
VORTEXION Auto Transformers to B.E.S.A. Specification, 100, 110, or 120v. to 200, 220 or 240 volts, 60 watts, 7/3; post 9d.; 120 watts, shrouded 12/6, open type 10/6, post 1/-; 200 watts, open 14/6, shrouded 16/6, post 1/-; 300 watts 30/-, 2,000 watts £4/10.
VORTEXION 600-watt Transformers; £4/10, carriage free.
VORTEXION 30h. at 60 m.a. Chokes, 5/6; 40h. at 60 m.a., 8/6; 30h. at 150 m.a., 200 ohms, 10/6 open type, 12/6 shrouded.
VORTEXION 200v. 30 m.a. Eliminators, 110 or 220 input with 4v. 4a. winding; 37/6.
VORTEXION—Transformers made to your specification. All standards in stock. Phone all hours.
VORTEXION (S. A. Brown), 182, The Broadway, Wimbledon. Tel.: Liberty 2814. [3117]

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

Did you hear those organ notes?

That's what Filson Young asked, after Mr. Taylor had played down to 32 cycles and up to 8,000 on the B.B.C. Organ.

Our customers did

If you didn't, send a 1½d. stamp for "NEW NOTES IN RADIO."

Hartley Turner Loudspeakers

D.C. Model £7.7.0
A.C. Model £8.8.0

Demonstrations any time by appointment.

HARTLEY TURNER RADIO LTD.,
Thornbury Road, Isleworth, Middlesex.

Tel.: Hounslow 1854.

We are demonstrating this remarkable new

HARTLEY TURNER moving coil loudspeaker daily between 12 and 3 p.m., and 4 and 6 p.m. Other times by appointment.

Easy Payment Terms for the Hartley Turner Moving Coil Unit, complete with special transformer, carriage paid, are as follows:

D.C. Model, cash price £7.7.0 or 20/- with order and 11 monthly payments of 12/9.

A.C. Model, cash price £8.8.0 or 26/- with order and 11 monthly payments of 14/-.

We supply all other high-grade radio apparatus on convenient easy payment terms. Please send us your enquiries and a quotation will be sent by return.

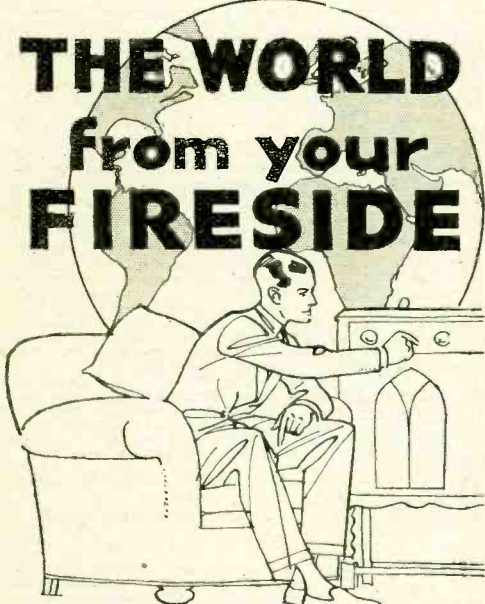
THE LONDON RADIO SUPPLY CO.

(Established 1925)

11, Oat Lane, Noble Street, London, E.C.2

(off Gresham Street)

Phone: National 1977.



WITH YOUR PRESENT SET!

Here is a wonderful instrument that will give you tremendous range with your receiver.

Short wave stations can be tuned in with most receivers when fitted with an "ELEX" Short Wave Converter. Programmes from Australia, America and other distant countries are brought in without trouble even by those with little or no experience of Short wave reception.

You can spend many thrilling hours tuning in distant countries and your friends will be amazed at the remarkable increase in the range of your set.

Price 52s. 6d. (less valves). Send for Booklet No. C.46.

J. J. EASTICK & SONS, 118, Bunhill Row, London, E.C.1. Phones: Met. 0314 (6 lines).

Components, etc., for Sale.—Contd.

(This advertisement continued from previous page.)

ORMOND Condensers, 2-gang semi shielded, 2/6.

WESTERN ELECTRIC Mains Transformers, input 200-250 volt, output 500-500 volt, at 150 milliamps. 4v. 4a., 4v. 2.5a., 4v. 2a., 4v. 1a., 4v. 1a., massive job; 19/6.

T.C.C. Electrolytic Condensers, 100 volts working, 15 mfd.; 1/3.

SPECIAL Offer of Mains Transformers, manufactured by Philips, input 100-115v. or 200-250 v., output 180-0-180 volts, 40 m.a., 4v. 1a., and 4v. 3a., 4/6; 200-0-200v., 4v. 1a., 4v. 3a., 4/6.

ALL Premier Guaranteed Mains Transformers have engraved terminal strips with terminal connections, input 20-250 volts, 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8 Transformer, 250v. 60 m.a., rectified, with 4v. 3.5a. c.t. L.T., and screened primary, 15/-; with Westinghouse rectifier, 25/-.

T.C.C. 2,000+2,000 Electrolytic, 12 volts working; listed 27/6, at 10/-.

ROLA F5 P.M., 18/6; Rola F6 P.M., 22/6; Rola F7 P.M., 32/-; please state whether power or pentode transformer.

PREMIER H.T.9 Transformer, 300v. 60 m.a., rectified, with 4v. 3.5a. c.t. L.T., and screened primary, 15/-; with Westinghouse rectifier, 25/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3.5a. c.t. L.T., and screened primary, 15/-; with Westinghouse rectifier, 25/-.

PREMIER Mains Transformer, output 155v. 80 m.a., for voltage doubling, 8/6; 4v. 3.4a. c.t. L.T., 2/- extra; Westinghouse rectifier for above, giving 180v. 30 m.a., 8/6.

PREMIER Mains Transformers, output 250-0-250 volts, 60 m.a., 4v. 1.2a., 4v. 2.3a., 4v. 3.4a. (all c.t.), with screened primary; 15/-.

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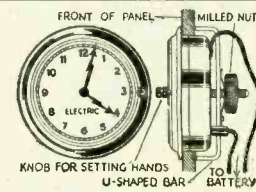
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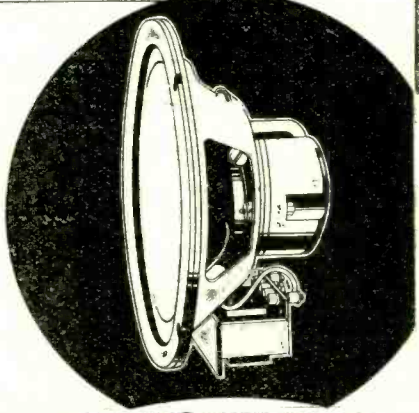
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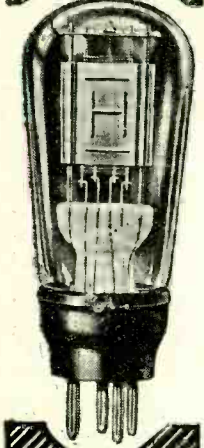
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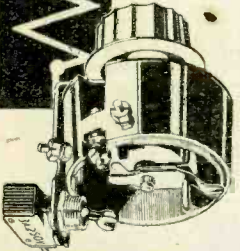
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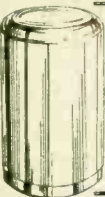
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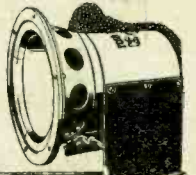
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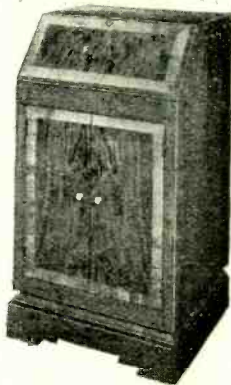
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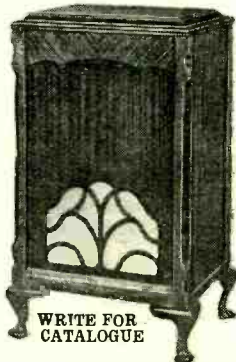
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- WEST REGIONAL** Ballad concert.
- SCOTTISH REGIONAL** Excerpt from the Glasgow Mod, 1933, from St. Andrew's Hall, Glasgow.
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- BRUSSELS (No. 1)** 5.0 p.m. Mendelssohn concert, by the Station Symphony Orchestra. 6.30 p.m. Pianoforte recital, by Raoul Seitarls.
- BRUSSELS (No. 2)** 8.0 p.m. Lalo concert, by the Station Symphony Orchestra, conducted by A. Meulemans.
- COPENHAGEN** 8.10 p.m. Haydn recital, music for flute, violin and 'cello.
- HEILSBURG** 9.10 p.m. The Königsberg Opera House Orchestra, conducted by Brückner.
- HUIZEN** 8.10 p.m. Concert by the Haydn String Quartet.
- LEIPZIG** 8.0 p.m. Opera: "Alceste," by Gluck, from Dresden.
- POSTE PARISIEN** 9.15 p.m. Comic opera: "Le Toréador," by Adam.
- ROME** 8.30 p.m. Opera: "La Sonnambula," by Bellini.
- TURIN** 8.30 p.m. Orchestral concert, conducted by D. Amfitheatri.
- WARSAW** 8.0 p.m. Symphony concert, conducted by Fitelberg.

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824 kc/s, 364 metres; 13 kW.—8.10 p.m., Shipping Notes. 8.15, Agricultural Report and Weather Forecast. 8.20, Agricultural Talk. 8.35, Wind Instrument Solos. 8.55, News. 9.0, Time. 9.2, Lottery Results. 9.10, Instrumental and Vocal Concert. 9.45, News. 9.50, Concert (contd.). 10.30, News. 10.35, Instrumental Concert.

ATHLONE
725 kc/s, 413 metres; 60 kW. Relayed by Cork. 1.337 kc/s, 224.4 metres.—1.30-2.30 p.m., Time Signal, Weather Report, Stock Exchange Quotations and Gramophone Music. 6.0, Programme for Children. 6.45, News. 7.0, Gardening Talk by G. O. Sherrard. 7.15, Literary and Dramatic Talk by Aodh de Blacum. 7.30, Time Signal. 7.31, Songs by The Good Companions. 7.45, Concert by the Station Orchestra. 8.15, The Good Companions (contd.). 8.30, Tenor Solos by Sean O'Carroll. 8.45, Music by the Station String Orchestra. 9.10, Soprano Solos by Nellie Ryan. 9.30-10.30, Programme by the I.B.C. (Ireland), Ltd. 9.33, Concert: Hustlin' and Binstlin'; Till tomorrow; My Darling; What more can I ask?; The Lord Mayor's Show; Play, Fiddle, play; Rock-a-bye Moon; Jack Payne's Memories. 10.3, Concert arranged by the International Broadcasting Company (Ireland), Ltd., on behalf of Hospitals' Trust, Ltd.: Overture, Figaro (Mozart); Hungarian Dance in G minor (Brahms); Autumn Leaves (Vogelin); Shepherd's Hey (Grainger); Violin Solo, Caprice viennois (Kreisler); Slav Dances (Dvorák); Waltz, Acclamation (Waldteufel). 10.30, I.B.C. Goodnight Melody, followed by Time Signal, News, and Weather Report. 10.40, Accordion and Fiddle Solos by John Haugh and J. Carroll. 11.0 (approx.). Close Down.

BARCELONA
EAJ1, 860 kc/s, 348.8 metres; 8 kW.—7.0 p.m., Trio Concert: Overture, Zampa (Hérold); Fenille d'album (Chabrier); Melody (Leopold); Intermezzo (Pérey); Sailor's Song (Mendelssohn); Romance (Rubinstein); Selection from Hérodiade (Massenet). 8.0, Request Gramophone Records. 8.30, Exchange. 9.0, Gramophone Music and News. 10.0, Chimes from the Cathedral, Weather, Messages to Seamen, Exchange and Market Prices. 10.10, Concert by the Station Orchestra. 11.15, Vicente Diez de Tejada reads from his own Works. 11.30, An Opera on Gramophone Records. In the interval at 12 Midnight, News. 1.0 a.m. (Saturday), Close Down.

BASLE.—See Schweizerischer Landessender.

BELGRADE
697 kc/s, 430.4 metres; 2.8 kW.—6.55 p.m., Time and Programme Announcements. 7.0, Concert by the Station Orchestra. 8.30, Concert relayed from Zagreb, 977 kc/s (307 metres). 10.30, Time and News. 10.45 (approximate), Dance Music from the Ratnicki Dom Restaurant.

BERLIN
DEUTSCHLANDSENDER (REICHSENDER) 783.5 kc/s, 1,625 metres; 60 kW.—12 Noon, Weather. 12.2 p.m., Gramophone Concert: Morning (Grieg); Oriental Suite (Poppy); Moonlight on the Danube (Gay); Wedding Day on Trollhaugen (Grieg); O komm' im Traum (Liszt); None but the lonely heart (Tchaikovsky); Suite caempstre (Amadei); Slav Dance No. 8 (Dvorak); The Flight of the Bumble Bee (Rimsky-Korsakov); Japanese Cherry Blossom Festival (Yoshitomo); Procession of the Gnomes (Bloni); Waltz, Mia Bella (Sommerfeld). 12.55, Time Signal. 1.45, News. 2.0, Gramophone Concert: Balalaika Orchestra: (a) Piece from Caucasian Sketches (Ippolitov-Ivanov). (b) Ukrainian Sketches (Sibirsky); Cigany Band: (a) Folk Song, Chrysanthemum. (b) Pusztá-Grisse (Kiss-Bela); Hawaiian Band (a) Melody (Payne-Wallace-Herbert). (b) Waltz, Tesoro mio (Beucucci); Bandonion Solos: (a) Intermezzo, Kokerterie (Mahr). (b) Russian Waltz (Mahr); Cigany Band: (a) Abschied von der Pusztá (Jeno). (b) Strahlende Augen (Falossy); The Wur-bitzer Organ: (a) Weist du noch. (b) Butterflies in the Rain (Myers). 3.0, Programme for Girls. 3.30, Weather and Exchange. 3.45, Reading from Lucinde (Schlegel). 4.0, See Leipzig. 5.0, Reminiscences by Alwin Dressler. 5.15, Songs by Children. 5.45, Topical Talk. 6.0, Poems. 6.5, Modern Music by the Karl Ristenpart Chamber Orchestra: Serenade for String Orchestra (Richard Trunk); Kleine Serenade (Reznick). 6.40, Talk by Dr. Schlange: The Prussian-South German State Lottery. 7.0, Transmission for all German Stations: Wilhelm Busch—Radio Sequence (Heinz Schwitzke). Music by Hans Joachim Sobanski. 8.0, To-day's Motto. 8.2, Concert from Munich. 8.30, Der ewige Bauer—Radio Play (Josef Martin Bauer). 10.0, News. 10.45, Weather. 11.0, Concert of Light Music. 12.30 a.m. (Saturday), Close Down.

BRATISLAVA
1,076 kc/s, 279 metres; 14 kW.—6.25 p.m., Gramophone Music. 6.40, Sports Talk. 6.55, Talk for Housewives. 7.0, See Prague. 7.25, See Brno. 7.55 till Close Down, See Prague. 10.15 (approx.), Close Down.

BRESENLAU
923 kc/s, 325 metres; 60 kW. Relayed by Gleiwitz, 1,184 kc/s, 253 metres.—1.5 p.m., Gramophone Music. 1.45, Time and News. 2.10, Schubert Lieder Recital by Else Schulze (Soprano). 2.40, Gramophone Concert. 3.0, Agricultural Prices. 3.15, Programme for Young People. 3.45, Tales of the Pioneers of Gliding. 4.0, Concert by the Station Orchestra, conducted by Topitz: Overture, The Daughter of the Regiment (Donizetti); Polka, Wiener Bürger (Ziehrer); Polka, Bitte schön (Strauss); Selection from La Traviata (Verdi); Ballet Overture (Kremsler); Selection from Ihre Höheit die Tänzerin (Goetze); Waltz, O du Himmelblauer See (Müllacker); March (Ziehrer). 5.20, Agricultural Prices, followed by Reading. 5.45, Talk: Germans outside the Reich—German Settlements in the Baltic Lands and Russia. 6.10 (from Gleiwitz), Industry on the Frontier—Radio Report from a Blast Furnace. 6.40, See Berlin (Deutschlandsender). 6.50, Meat Market Prices. 7.0, Transmission for all German Stations relayed from Berlin (Deutschlandsender). 8.0, News. 8.10, Concert by the Silesian Philharmonic Orchestra, conducted by Hoffmann. Soloist: Charlotte Boerner (Soprano). The London Symphony in D (Haydn); Aria from Il Seraglio (Mozart); Overture, Così fan tutte (Mozart); Aria from Figaro (Mozart); Overture, Euryanthe (Weber); Minuet, Dance of

BRNO
878 kc/s, 342 metres; 35 kW.—2.50 p.m., Concert by the Station Orchestra, conducted by Bakala: Overture, Figaro (Mozart); Mendelssohn Potpourri (Fouilds); Waltz from Der Rosenkavalier (R. Strauss); Serenade for Strings (Hrimaly); Bacchanal (Dvorák). 3.50-4.0, See Prague. 5.45, Gramophone Music. 5.55, Talk for Women: Rhythmic. 6.5, Gramophone Music. 6.15, Talk for Workers. 6.25, German Transmission: News, Sports Notes, Topical Talk and Readings. 7.0, See Prague. 7.25, Haydn Chamber Music: Four Pieces for Flute; Quartet in D for Flute, Violin, Viola and 'Cello. 7.55, See Prague. 9.30, Pianoforte Recital by Norbert Matzek. 10.0, See Prague. 10.15 (approx.), Close Down.

BRUSSELS (No. 1)
N.I.R.; 887 kc/s, 338.2 metres; 15 kW.—12 Noon, Acts II and III of Lucia di Lammermoor (Donizetti), on Gramophone Records. 1.0 p.m., Le Journal Parlé. 1.10, Modes of Travelling—Gramophone Concert. 5.0, Mendelssohn Concert by the Station Symphony Orchestra, conducted by Meulemans: Overture, Ruy Blas; Spring Song; Spinning Song; Symphony in A Minor—The Scottish. 6.0, Talk: Wireless Reception and its Development in Belgium and Abroad. 6.15, Request Gramophone Music. 6.30, Pianoforte Recital by Raoul Spitaels: Spanish Suite (Albeniz); Waltz (Chopin); Dances (Debussy); Rondeau brillant (Weber). 6.45, Symphony No. 1 (Beethoven), on Gramophone Records. 7.15, Talk. 7.30, Legal Talk and Literary Talk. 8.0, Concert by the Radio Orchestra, conducted by Walpot. Soloist, Mlle. De Troch (Soprano). Overture and Air de Ballet from Paul's Flute (Van Oost); Waltz, Les sirènes (Waldteufel); Selection from Paganini (Lehár); Songs: (a) Aria from Alceste (Gluck). (b) Aria from Cavalleria rusticana (Mascagni); Selection from White Horse Inn (Stolz-Benatzky). 8.45, Talk: Ghent and its People. 9.0, Concert by the Station Symphony Orchestra, conducted by Meulemans: Overture, Anacréon (Cherubini); Petite suite (Büsser); Scherzo-Valse (Guillaume); Two Symphonic Pieces (Bernart); Scènes alsaciennes (Massenet); March héroïque (Saint-Saëns). 10.0, Le Journal Parlé. 10.10, La Brabançonne.

BRUSSELS (No. 2)
N.I.R.; 887 kc/s, 338.2 metres; 15 kW.—Programme in Flemish. 12 Noon, Concert by the Primas Sylva Orchestra. In the interval at 1.0 p.m., Le Journal Parlé. 5.0, Concert by the Radio Orchestra, conducted by Charles Walpot: Unie-marche (Walpot); Waltz, Josef Strauss Erinnerung (Fahrbaeh); Overture, The Black Domino (Auber); Suite from Maia (Leoncavallo); Negro Lullaby (Clutsam); Selection from The Count of Luxembourg (Lehár); Flemish Dances (Blockx). 6.0, Finale from The Valkyrie—Opera (Wagner), on Gramophone Records. 6.15, Reading. 6.30, Sonata in F Sharp Minor, Op. 46, for 'Cello and Piano-forte (Pierne). 7.0, Tone Poem, Tamar (Balakirev), on Gramophone Records. 7.15, Talk: Family Names. 7.30, Wireless Talk. 8.0, Lalo Concert by the Station Symphony Orchestra, conducted by Arthur Meulemans. Soloist, Theo Delvenne (Violin). Overture, Le roi d'Ys; Violin Concerto; Scherzo; Norwegian Rhapsody; Selection from Mamouna. 9.0, Reinct de Vos—Play, adapted for Radio by Hubert Melis, with Incidental Music by Paul Douliez. 9.45, Three Fanciful Etchings (Ketelbey), on Gramophone Records. 10.0, Le Journal Parlé.

BUCHAREST
761 kc/s, 394 metres; 12 kW.—5.0 p.m., Concert by the Station Orchestra: March, Mambattan (Souza); Waltz Intermezzo (Transilateur); Rocco Suite (Albott); Selection from The Circus Princess (Kálmán); Melody (De Michel); Potpourri, Extravaganza (Morena); Souvenir (Hebert); Trot de cavalerie (Rubinstein); Rigandon (Hartog). In an interval at 6.0, Radio Journal. 7.0, Educational Talk. 7.20, Talk. 7.40, La Bohème—Opera in Three Acts (Puccini), on Gramophone Records. In the intervals, Reading and Radio Journal. After the Opera, Light Music relayed from a Restaurant.

BUDAPEST
545 kc/s, 550.5 metres; 18.5 kW. Also relayed on 840 metres from 7.15 p.m. till Close Down.—5.0 p.m., Cigany Band Concert. 6.0, Talk. 6.30, Song Recital. 7.15, Two One-Act Plays. 8.0, Extracts from The Barber of Seville—Opera (Rossini) on Gramophone Records. 8.45, News. 9.0, Dance Music from the Hotel Royal. 10.15, Orchestral Concert: Overture (Cimarosa); Sonata da Camera (Mareello); Allegro alla militare (Boccherini); Suite antique (Comperin-Kreisler); Suite, In moto popolare (Cui); Lieder (Lavata). 11.15, Cigany Band Concert from the Restaurant Kovacevics.

CASSEL.—See Frankfurt.

COPENHAGEN
1,067 kc/s, 281 metres; 0.75 kW. Relayed by Kalundborg, 260 kc/s, 1,153.8 metres.—12 Noon, Time Signal and Chimes from the Town Hall. 12.2 p.m., Concert by the Bendix String Ensemble, relayed from the Wivex Restaurant. 2.0, Interval. 2.30, Concert by Louis Prell's Instrumental Ensemble: Nura March (Audy); Suite of Viennese Waltzes (Gipson); Humoresque (de Teye); Sylvia (Spenks); Rogne Song Fantasy (Stotliart); Potpourri, Von Wien durch die Welt (Hrubby); Melody (Breuer); Zazra (Bowen); Die Spieluhr der Pompadour (Noack); Valse dolore (Gyldmark); Selection from Wonder Bar (Katscher); Indigo from Three Shades of Blue (Gröfé); Foxtrot, Turf (Demaret); Canonetta (Friml); Foxtrot, Business in Q (Bleyer). In an interval at 3.15 (approx.), Reading. 4.30, Programme for Children. 5.30, Exchange and Fish Market Prices. 5.45, Talk: The Masterpieces of Danish Literature. 6.15, Elementary German Lesson. 6.45, Weather. 6.54, Announcements. 7.0, News. 7.15, Time Signal. 7.16, Talk: Unemployment and the Wages Question. 8.0, Time Signal from the Town Hall. 8.1, Programme by Per Knutzon. 8.10, Haydn Recital by Holger Gilbert-Jespersen (Flute), Johan Henriques (Violin), and Torben Anton Svendsen ('Cello): Divertimento in C for Flute, Violin and 'Cello; First Movement from the Trio in D for Flute, Violin and 'Cello. 8.30, Nathan the Wise—Dramatic Poem (Lessing). 10.15, News. 10.30, Concert of Light Music by the Venetian Trio and Aase Wallenström (Songs). 11.0, Dance Music by Kai Julian and his Band, relayed from the Valencia. 12 Midnight (approx.), Close Down.

CORK.—See Athlone.

DANZIG.—See Heilsberg.

BREMEN.—See Hamburg.

BRESLAU

FECAMP

1,328 kc/s, 225.9 metres; 10 kW.—11.0 a.m. to 2 Noon, Programme in English by the I.B.C. 11.0, Happy Hour. Part I: Orchestral Concert: Signature Tune; Overture, Die Fledermaus (Strauss); Fleurette (Fletcher); Violin Solo, The Song of Songs (Moya); Wedding of the Rose (Jessel); Bells across the Meadows (Ketelbey); Xylophone Solo, Danse d'Hesoin (Abbey); Columbine (Part II: Dance Music: Merry-go-round; Saratoga Swing; Sophisticated Lady; Balloons; Junk Man Blues; My Wishing Song; You did everything for me; My woman; Sadie the Skater; Signature Tune. 12 Noon, Pro-

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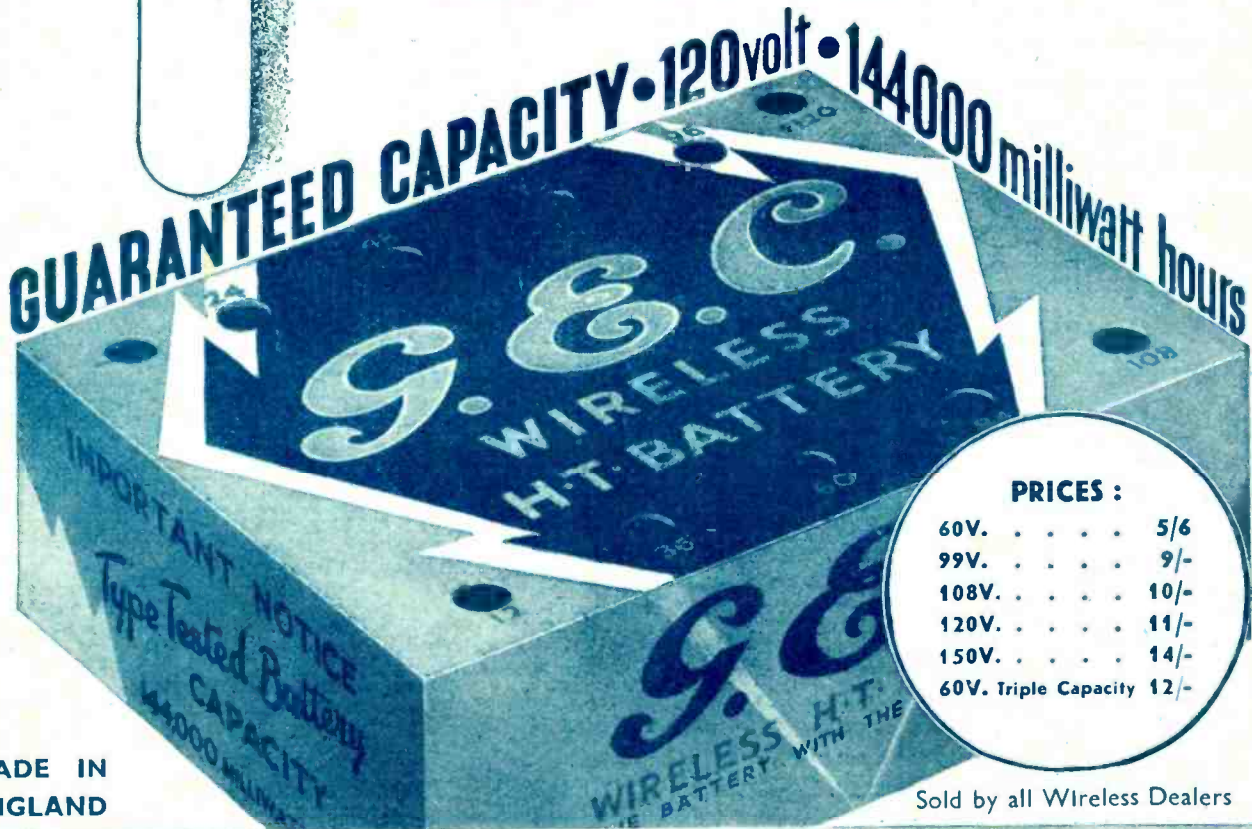
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