RADIO BYGONES

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No. 10 – April/May 1991

Minimalist Restoration of a Wartime Civilian Receiver

'Famous Names' No. 1 – Radiospares ☐
Seagoing Recollections 1927–46 ☐
Radio Valves & Tubes – 2: Military Equivalents ☐

MUSEUM PIECES

This month, a selection of valve cartons such as once graced the shelves of radio shops, some bearing famous names and others not quite so famous. All cartons from the Historic Wireless Collection of Bill Journeaux of Poole, Dorset

Top picture: Two Marconi boxes for DER valves which were made at the Osram Lamp Works, Hammersmith, London W6, from about 1923 to 1925. The one on the left is apparently the earlier of the two, and certainly the more 'jazzy' in design. On the right, the box for a Mullard PM1HL 2 volt battery valve. Bottom picture: From left to right, boxes from Cossor, Tungsram (a firm with Hungarian origins), and Ediswan (the Edison Swan Electric Company). Their PV5DE was introduced in 1925

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IT WAS, OF COURSE, devised a very long time before wireless or radio, call it what you will, came upon the scene. It has evolved and developed over the years, and despite a relentless move towards the adoption of more modern methods, it is still in use world-wide by the military, by professionals, and by hobbyists. There are national and international clubs and magazines devoted to it, and a vast amount of heated discussion takes place about it between its devotees and its detractors.

What am I talking about? Why, Morse code of course! You may love it or you may hate it, but you can't ignore it if you listen in to the radio, especially on the short wave bands, though it seems to intrude less into the broadcast bands than it used to.

During this coming month, Saturday, April 27th is the occasion of the 200th anniversary of the birth of Samuel Finley Breese Morse, the man who gave his name to the whole thing. Many special event stations are being put on the air by amateur radio clubs and by individual amateurs on that day, some extending to several days around that time, hoping to communicate with other Morse code enthusiasts all over the world.

Our sister magazine *Morsum Magnificat* is joining in the celebrations, with a Bicentennial Special Issue being published at the beginning of April. This contains a host of articles on the origins and development of the Morse code, and the personalities who were involved. Details of subscription rates for *MM* will be found on page 31 of this issue, but we are arranging to make individual copies of the Bicentennial Special Issue available for those who would like a memento of the occasion. The price for that issue including postage to UK addresses is £2.00. Overseas the price is £2.15 (or US $4.00 in cash only) by surface mail; £2.65 (or US $5.00 in cash only) by airmail.

Although it was originally devised for use on land-line circuits, the Morse code has an inescapable link with the development of radio communication over the years. I felt it only right, therefore, that we should mark the occasion with an article on some aspect of Morse here in *Radio Bygones* too. In line with my policy of trying wherever possible to find articles with a different or unusual viewpoint, this one looks at the history of Canadian keys. I hope you will enjoy it – who knows, perhaps it might persuade some of you to join the intrepid band of key collectors!

Geoff Arnold

In This Issue

News & Events

New Book

In recent years, a number of books have been devoted to the histories of individual companies in the radio, TV and electronics industries, some of them sadly unavailable to the general public. Now, the British Radio and Electronic Equipment Manufacturers' Association (BREMA) has published a most intriguing book devoted to the many companies and people who have had a hand in the evolution of home entertainment over the past 70 years.

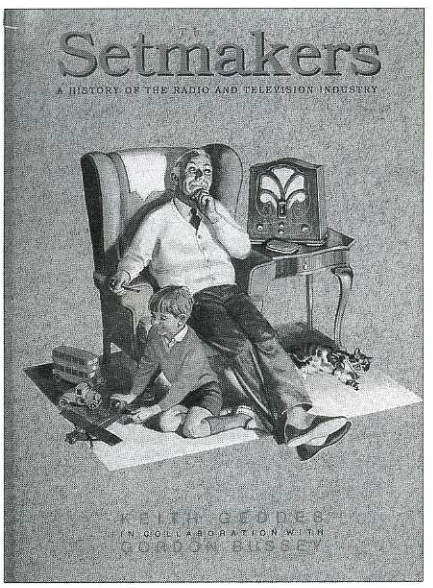
The Setmakers, written by Keith Geddes in collaboration with Gordon Bussey, is the result of two years of intensive research and of interviews with the people who were involved, from apprentices to management. It has 464 pages and includes nearly 500 photographs (over 100 in colour). Keith Geddes comments: 'The industry's story has many of the ingredients of a Hollywood epic power struggle, with personality clashes, and the rise and fall of great names. And all this was against a background of massive cash stakes'.

The book recalls some of the great brand names of the past (Ekco, Vidor, HMV to name but a few) and contains a mass of intriguing archival material much of which has never previously been made public. It charts the fascinating development of technology that has led to the modern marvels of television, VCR and compact disc, which we now take for granted. And it is not afraid to talk about the mistakes, as well as the successes.

Authoritative yet eminently readable, the book concludes by looking at the current state-of-the-art as the industry faces new challenges. These include changing conditions as a result of the Broadcasting de-regulation, the introduction of satellite and the prospects for high definition television.

BREMA is selling the book on a non-profit making basis, to reflect its importance as part of our social history and with the aim of ensuring that it reaches a wide audience.

The Setmakers is published in hardback, with 464 pages measuring 9½ x 6¾in. It is available by post from **BREMA (The Setmakers), PO Box 52, Middlesbrough, Cleveland TS2 1RR**, price £14.95 including £2.50 packing and carriage in the UK. Cheques or postal orders should be made payable to BREMA (Setmakers).



I would recommend this fascinating book to anyone with an interest in the history of the domestic radio industry in the United Kingdom. I would consider it well worth the price for the illustrations alone – the wealth of facts and background information are an added bonus.

Geoff Arnold

New Book

John W. Stokes has now written a companion volume to his earlier book, *The Golden Age of Radio in the Home*, which concentrated on the early days of radio in New Zealand.

The new work, published in December 1990, is entitled *More Golden Age of Radio*, and includes material which was unavoidably left out of the earlier volume, as well as much new material not previously available. The section on Australia is more comprehensive in this volume; other sections cover New Zealand, the United States, Canada and Great Britain. The inclusion of over 1500 illustrations, many of them previously unpublished, make this book a valuable addition to the radio hobbyist's library.

More Golden Age of Radio is published in hardback, under ISBN 0 908629 29 X, with 208 pages 8 x 12in.

Sales to the American and European markets are handled by the **Vestal Press Ltd., PO Box 97, Vestal, NY 13851-0097, USA**. The price is US $39.95.

Readers in the UK can obtain copies without the hassle of making payment in foreign currency by ordering from **The Vintage Wireless Co. Ltd., Tudor House, Cossham Street, Mangotsfield, Bristol BS17 3EN**, price £24.95 collected or £27.45 post paid. The Vintage Wireless Co. Ltd. also stock *The Golden Age of Radio in the Home* at £19.95 collected or £22.35 post paid UK.

Wanted

Arriving just too late for a mention in our last issue, the *1991 Wants List* from **The Vintage Wireless Company Ltd., Tudor House, Cossham Street, Mangotsfield, Bristol BS17 3EN**, a comprehensive listing of radio and audio equipment and valves wanted. Worth sending for a copy if you have equipment or bits and pieces for disposal.

Collins Owners Club

The Collins Owners Club was formed in 1983 with the objective of bringing together owners of Collins amateur radio, or related, equipment who would like to contribute to maintaining the marque. The club is not intended to provide a service facility nor spare parts. It meets its objective by supplying a copy of the List of Members, showing their addresses and equipment owned, and a Newsletter, published three times a year.

It is hoped that members will communicate amongst themselves on particular specific problems, or through the Newsletter in the case of giving or requiring general information, including sales and wants. Although membership is mostly from the UK, the Club is interested in developing links with North America and recruiting some new members from 'across the pond', especially if they have knowledge of equipment originating from pre-1950.

Intending members should write to **R. P. Ralph G4KSG, 62 Northdown Road, Solihull, West Midlands B91 3ND**, sending a cheque or postal order for £3.00 (US $6.00) made payable to R. P. Ralph, together with three 'DL' sized (9 x 4in) self-addressed envelopes bearing First-class stamps, and a list of the Collins equipment owned, including all ancillaries and quoting serial numbers. Overseas readers should send 6 IRCs (Europe) or 12 IRCs (rest of the world) instead of envelopes.

New Book Follow-up

Since writing about *Radios von Gestern* in *RB* No. 7, I have had a chance to see a copy of the book. Wow! It really is amazing, with many excellent quality photographs of equipment, and also sections devoted to circuit techniques, components, valves, restoration and repair, etc.

As mentioned previously, all the text is in German, which is obviously a problem for anyone not fluent in that language. I can only say that I am so impressed by the book that I have embarked on a course in German!

Geoff Arnold

FREE READERS' ADVERTISEMENTS

You can advertise your goods for sale or wanted, using up to a maximum of 30 words including whatever details of your name, address, telephone number, etc., that you wish to be published in the advert.

Please ensure that you write your advertisement clearly, preferably in block letters or typewritten, and include the corner flash cut from the current issue of *Radio Bygones*, (see below). Every advertisement sent in **must** have your full name and address attached, even if you do not want those details published in full.

This service is for the use of *Radio Bygones* readers for their private sales and wants only. Any advertisements from traders, or apparent traders, will be rejected.

SEND YOUR ADVERTISEMENT TO:
Radio Bygones, 8A Corfe View Road,
Corfe Mullen, Wimborne, Dorset BH21 3LZ,
marking the envelope 'Readers' Advert'.
The closing date for adverts to appear in our next issue, due out on May 28, is May 8.

WANTED

Vintage communications receiver – up to £500 for near mint model. Makes in order of preference: Eddystone, Hallicrafters, HRO, Racal, Marconi, 'services'. Others considered. Taylor, 27 Christopher Way, Emsworth, Hants.

Holder for a Wecovalve. Marconi holder for S625 valve. Telsen 0.0005µF air-spaced tuning condenser. Sapphire-tipped needles for 78rpm radiogram. Small horn loudspeaker S G Brown H2 or H4. Norman Richardson, 2 Edna Road, Maidstone, Kent, telephone 0622 685443.

Grundig reel-to-reel recorders, particularly models 500 and 700, also any original service manuals and spares for all models. Telephone Mike G8CTJ on Hinckley (0455) 250570 anytime.

For Bendix ARN-7 Radio Compass: Control Box C4/ARN-7 and 22-pin female plug PL-122. For Marconi AD7092 ADF: Loop Type 1264B. John Mackesy, PO Box 87, Mt. Evelyn, Victoria 3796, Australia.

Mechanical type bug key of Vibroplex, Eddystone or other manufacture. If you have one for sale please telephone Reg G0NYR on Liverpool (051) 489 6833.

Wire recorder. Square wire. Info on Heathkit 10-12U 'scope. Douglas Byrne G3KPO, 52 West Hill Road, Ryde, Isle of Wight PO33 1LN or phone 0983 67665.

The book *Secret Warfare* by Pierre Lorain, translated by David Kahn. E. Langemyr LA3BI, Vestlivn 7B, N-1415 Oppegaard, Norway.

ARRL *Radio Amateur's Handbook*, late 1920s or early 1930s, condition unimportant. Please state price. Walker, 11 Highfield, Harlow, Essex CM18 6HE or phone 0279 436660.

Morse key, Stock No. 5805-99-652-6572, should be in good condition. Phone Peter GW7IZG, Milford Haven (0646) 698036 evenings.

Copy of STC's guide to their 5A, 5B, 5C series of valves, which included Loctal-based version of 807, etc. Can send sterling cheque for any data provided. N. W. Nicol ZR6AW, PO Box 41337, Craighall 2024, Transvaal, South Africa.

Receiver R1155 and any model PCR, complete but working or not, modified or unmodified. Please write Geoff Garner, 5 Cheriton Way, Northampton NN1 5SB.

FOR SALE

MCR1, R1/R2, also AVO Valve Tester, good working order. Your offers please to Eric Page, 'Seacroft', Clos du Murier, St Sampson, Guernsey, Channel Islands.

Ekco Model A28 (1946) nine-band receiver, including TV sound channel. Handsome cabinet, chassis requires overhaul. Service manual available. £50. A. L. Wragg G3WEX, 29 Eastern Road, Sutton Coldfield B73 5PA or phone 021-354 4265.

Radio & Television Servicing, 16 continuous volumes, from number one up to 1968/69. Buyer to inspect and collect. Offers to Dave Warner G4AFQ (Ashford, Middlesex), or phone 0784 254307 any time.

Radio Valves and Tubes – 2

UK & US Military Equivalents, pre-1944

by Geoff Arnold

As mentioned in the last issue of *Radio Bygones*, the systems of type numbering for valves which were introduced in the British Armed Services during the First World War were seemingly among the first to try to bring some sanity and order to the matter.

These systems were expanded to take account of new devices as they appeared, and remained in use up to the introduction of the 'CV' (Common Valve) numbering system, following the first publication of the *CV Register of Electronic Valves* in December 1944.

The type codes used by the Royal Navy all began with the letter 'N' for Naval, as in NR for Naval Receiving, or NT for Naval Transmitting. Similarly the Army used the letter 'A', as in ARP for Army Receiving Pentode, or AU for Army Uni-directional (i.e., rectifier).

The Royal Air Force, rather than choosing a Service-related initial letter, decided instead to use the letter 'V' for Valve, as in VCR for Valve, Cathode Ray (i.e., a cathode-ray tube) or VT for Valve, Transmitting (see page 8 of *RB* No. 9 for the full lists of identifying prefixes).

That use of VT brought an unfortunate complication in that the same abbreviation had been used by the British Post Office from the earliest days as a prefix to the type numbers for the valves used in its telephone repeaters, etc. In that case the letters stood for 'Valve, Thermionic'. As if that was not enough, the United States Army used VT, standing this time for 'Vacuum Tube', as the prefix in its numbering system from 1917 to about 1943!

In the following pages, you will find lists of the valves used in the three British Armed Services and in the US Army. In each of those lists, the Services type number is related to the corresponding number in the CV Register, and to the comparable commercial type. Note that the commercial types are not necessarily **direct** equivalents or replacements, but only **comparable** types. Often, the military valves will be modified or specially selected versions of commercial types. It is particularly important to remember this fact if you are tempted to try to use the lists 'in reverse', to find a commercial type to fit as a replacement in a piece of military equipment.

For the three British Services lists, you will also find a column headed 'Stores Ref.' Anyone who has delved inside much British military radio equipment is likely to have come across sets where the only identification of valve types consists of a table pasted inside the cover bearing mystic numbers beginning with such identifiers such as '10E/' or 'ZA' or 'APW'. Sometimes this happens in the parts lists printed in handbooks and technical manuals as well. These are the Old Stores Reference Numbers, which were also replaced, so far as valves were concerned, by the CV system.

Stores-handling organisations, whether military or civilian, take delight in allocating numbers of their own to any item, no matter that it is already adequately numbered by its manufacturer or supplier. Yes! I own up! I did the same in the days when I was responsible for running a stores department. The reason behind this confusing practice is, of course, that identical goods from different suppliers may have different catalogue or type numbers. Giving every stock line your own identifying code number can actually save a lot of confusion, both in the stores and in the field when the end-user is looking for a replacement part.

Further details of the Stores References used by each Service are given at the beginning of each table. When co-operation between the armed services of several countries was extended under the aegis of the North Atlantic Treaty Organisation (NATO), the separate systems for each Service were replaced by one under which each item of stores (not only radio and electronic) was allocated a 'NATO Stock Number' (prefix 'NSN'), alternatively known as an 'Identification' or 'Joint Services Catalogue Number' ('J.S. Cat. No.'). These are instantly recognisable by their format of 4 digits - 2 digits - 3 digits - 4 digits, for example a CV7085 power transistor has a Stores Number 5960-99-037-2160.

Yes! The CV numbering system was later extended to incorporate semiconductor devices!

Royal Navy

The Old Stores Reference Numbers used by the Royal Navy are known as 'Admiralty Pattern' (AP) Numbers. The general form of the code is 'AP' followed by a number consisting of three or more digits. Some items were allocated 'Admiralty Pattern, Wireless' (APW) Numbers.

Navy No.	Stores Ref. AP...	CV No (near equiv.)	Possible Commercial Substitute & *Notes*
CRTs			
NC1	W.306	950	4053
NC2	W.307	951	32A
NC3	W.308	952	4081
NC4	W.1070	953	32G
CRTs (continued)			
NC5	W.1071	954	20K
NC6	W.1307	955	4409
NC7	W.1308	956	4602 *with magnetic shield*
NC8	W.1920	957	32E
NC9	W.1921	958	26J
NC10	W.1851	959	*as NC5, wider spec*
NC11	W.2170	(960)	4503 *replaced by NC12*
NC12	W.3128	960	4201(modified)
NC13	W.6138	961	
NC13A	W.6138A	987	
NC14	W.6601	962	
NC15	-	1596	
NC16	53162	964	
NC17	53270	965	

Navy No.	Stores Ref. AP...	CV No (near equiv.)	Possible Commercial Substitute & *Notes*
CRTs (continued)			
NC18	53271	966	*replaced by CV1052*
NC19	54218	967	
NC20	-	989	
Gas-filled triodes			
NGT1	4803	1141	DQP
NGT2	W.269	1128	GT1C
NGT3	W.612	1142	MR75
NGT4	W.614	1143	GT1A
NGT5	W.1244	1144	BT19
NGT6	W.1306	1145	BT9A
NGT6A	W.1306A	1146	*as NGT6, high voltage test*
NGT7	W.1290	1147	BT35
NGT8	W.2512	1148	E.1191
NGT9	W.2973	1149	BT41
Receiving			
NR14	7406	1150	
NR15	7404	1151	PM3
NR15A	7404A	1152	L410, 610LF, PM4DX
NR16	7405	1153	PM254
NR16A	7405A	1154	P415, P425, 610XP
NR17	7407	1155	
NR18	7408	1156	DEQ
NR19	7409	1157	
NR22	7410	1158	S410, PM14
NR23	7412	1159	S410, PM14
NR26	8751	1038	164V, MHL4
NR27	8752	1160	104V, ML4
NR27A	W.1039	1161	104V, ML4 *as NR27, special tests*
NR28	8753	1019	P215, PM2
NR31	7413	399	AC/HL, MH4, 354V
NR35	7414	1163	PD220A
NR37	4408	1164	MS4, AC/SG
NR38	4427	1165	VMS4, VM4V, MVSG
NR39	3777	1118	PEN.220, PM22A, 220 OT
NR40	-	(1237)	
NR41	3795	1083	VP21, VP210, 210VPT
NR42	4407	1166	LP2, 220PA, P220, PM2A
NR43	3704	1167	PM24A
NR44	3832	1168	PX4, 4XP, AC044
NR45	3807	1169	VMP4/G, VP4A
NR46	3813	1170	D41
NR47	816	1040	PX25, DO24, PP5/400
NR48	850	1055	EBC33
NR49	1260	1056	EF36
NR50	412	1171	HA1, AT4, A40
NR51	1166	1172	VP4A, VMP4G
NR52	1607	1173	354V, MH4, AC/HL, 41MTL
NR53	1457	1174	PEN.4VA, KT42, MP/PEN, AC/PEN
NR54	5381	1175	ZA1, AP4
NR54A	W.790	1176	*as NR54, looser specification*
NR55	5382	1109	HL13C, HA1320
NR56	5529	1178	DA30, DO30, V503
NR57	5631	1179	TT4, ML4, ACP
NR58	W.122	1180	V312, 244V
NR59	W.263	1181	KT41, PEN.A4, AC2/PEN
NR60	W.264	1182	H42
NR61	W.265	1183	W42
NR62	W.266	1184	A373
NR64	W.281	1100	KTW61
NR65	W.282	1282	AC/S2/PEN, MSP4
NR66	W.283	1187	D41
NR67	W.1525	1280	X64, 6L7G

Navy No.	Stores Ref. AP...	CV No (near equiv.)	Possible Commercial Substitute & *Notes*
Receiving (continued)			
NR68	W.1526	587	DH63, 6Q7G
NR69	W.1527	1103	Y63
NR70	W.1065	1124	MS.PEN, SP4
NR71	W.1066	1129	MS.PEN.T
NR72	W.1067	1188	N43
NR73	W.1280	1285	ECC31, 6N7G
NR74	W.1301	1189	AC6/PEN
NR75	W.1302	1190	ACP4 *matched pair of NR94*
NR76	W.1303	1191	KTZ41
NR77	W.1295	1286	EL35, 6L6G
NR78	W.1528	581	6C5G
NR78A	-	(1932)	
NR79	W.1529	1192	Z62
NR80	W.1530	-	E.1148 *obsolete, see VR135*
NR81	W.1531	1941	6K7G
NR82	W.1532	1193	X65
NR83	W.1533	1074	6J7G, KTZ63
NR84	W.1534	1194	X41, 41STH, AC/TH1, TH4
NR85	W.1535	1186	KT63, 6F6G
NR86	W.1536	1195	KTW63
NR87	W.1628	1196	AC5/PEN.DD
NR88	W.1927	1197	RL18
NR89	W.2970	(35)	
NR94	W.2529	1198	AC/P4
NR95	W.3446	1287	
-	W.2164	1837	2B7
-	W.2161	612	57
-	W.2162	613	58
-	W.1528A	1932	6J5G
-	W.2077	509	6V6G
-	W.2165	1891	6B7
-	W.2166	585	6C6
-	W.2167	1900	6D6
-	W.2160	609	42
-	W.3446	1287	25L6G
Current & voltage stabilisers			
NS1	5458	1069	STV280/80
NS2	5459	1199	
NS3	7021	1200	Barreter 202
NS4	W.285	1201	4317
NS5	W.2697	1202	304
Transmitting			
NT1	4869	1203	
NT3	5232	1292	
NT4A	5199A	1204	
NT10	7050	1294	
NT13	-	2788	
NT17	7435	1205	
NT18	7436	1206	DA60, DO60
NT19	7437	1207	
NT20	7439	1208	P625, PM256
NT22B	7420B	1209	
NT22C	7420C	1210	
NT23B	6237B	1211	
NT23D	7419	1212	
NT24	7120	1213	
NT30	7430	1214	
NT31	7425	1215	
NT32B	1348B	1216	
NT33	7438	1217	
NT35	1959	1218	
NT36	3830	1219	DA100, MZ1-100
NT37	4656	1220	4033A

Navy No.	Stores Ref. AP...	CV No (near equiv.)	Possible Commercial Substitute & *Notes*
Transmitting (continued)			
NT38	4562	1293	
NT38A	4562A	1221	PZ1-75, PT6, SW75.PEN
NT39	813	1222	ACT.6
NT40	4687	1223	DET.5
NT41A	7429	1224	
NT43	7431	1225	
NT45A	1347	1226	
NT46R	-	1227	
NT48	1349	1228	
NT52	3910	1229	
NT54	3798	1230	
NT57	-	1231	
NT57A	W.337	1232	
NT57D	6675D	1233	
NT57T	W.560	1234	
NT58	4889	1288	DET.12, TY1-50
NT58A	W.580	1235	*as NT58, flexible a & g leads*
NT59A	4738A	1236	
NT62	3794	1237	PM24D
NT62A	3794A	1238	
NT63A	798A	1239	
NT65	-	(1240)	
NT65A	1512A	1240	PZ1-35
NT68	3191	1241	
NT68A	W.1699	1242	*as NT68, special cutoff test*
NT69	W.1231	1243	
NT75	W.267	1244	
NT77A	-	(50)	
NT78A	W.1691A	1245	
NT82	7418	1246	P2, PM202
NT83	7417	1247	
NT84	4556	1248	
NT86	W.1241	1249	
NT87	W.628	1250	4279A
NT90	W.1240	1251	
NT92	W.1069	1252	4212E
NT93	W.1305	1253	E.1161
NT97	W.2511	1254	E.1161(modified)
NT98	W.2510	1255	E.1189
Transmitting (continued)			
NT98A	-	1491	
NT98B	-	1492	
NT98C	-	1493	
NT98D	-	1494	
NT99	W.2514	1256	E.1232
NT100	W.2536	1257	E.1155
Rectifiers			
NU1	5233	1258	
NU2	5433	1259	
NU3	7403	1064	U12/14, DW4/500, UU1 0/500
NU4	7415	1260	
NU5	7416	1261	RX3-120
NU7	3822	1262	
NU8	3828	1263	
NU12	803	1264	U.18
NU13	4476	1265	U.15, RZ1-250
NU13A	4476A	1266	*as NU13, special HV tests*
NU15	6380	1267	U.4020
NU17	W.268	1039	1W4, UU5, 441U
NU17S	W.3394	1296	
NU18	W.284	1113	U17
NU20	W.1624	1268	U50
NU22B	7440	1269	
NU22C	7201C	1270	
NU23	7446	1271	
NU24	7449	1272	
NU25	7447	1273	
NU26	7448	1274	
NU26C	7448C	1275	
NU28	4589	1276	
NU29	3776	1277	
NU30	5476	1278	
NU31	W.613	1279	MU2
NU33	W.1068	1290	SU2150A
NU33A	W.1068A	1291	HVR2A
NU34	W.1304	1134	HVR2
-	W.4000	575	5U4G
-	W.3792	1863	5Z4G

British Army

The Old Stores Reference Number system used by the Army is far and away the most complex of the three British Armed Services, and I hope that there is a *Radio Bygones* reader somewhere who may be able to throw some more light on its 'ins and outs'!

The Old Stores Ref. may commonly take any of the following six forms:
'ZA' followed by 4 or 5-digit number;
'ZC' followed by a 4 or 5-digit number;
'ZA/' or 'ZC/' followed by the Navy's 'AP...' or 'APW...' Stores Code;
'ZA/' or 'ZC/' followed by 'AY' followed by the Navy's Stores Code with its 'AP' prefix omitted;
'ZA/' or 'ZC/' followed by the RAF's '10E/...' or '110E/...' Stores Code;
'Z/', 'ZA/' or 'ZC/' followed by the CV number.
You may also come across:
'ZA/' followed by 'US/' followed by an apparently arbitrary 4-digit number for certain valves of US origin;
'JC' followed by an apparently arbitrary 4-digit number.

Confusing enough, you may think, but there's more to come. Some valves have been given more than one Army Old Stores Reference No. – the worst I've come across is 12 codes for one valve. We simply do not have room in this issue to publish **all** the different numbers given in the official listings, and to some extent the one included in the table has been chosen by the time-honoured method of pin and blindfold.

My research into the background to this multiplicity of codes has proved fruitless. It has been suggested that different Stores References were issued to similar or equivalent valves from different manufacturers, or that a different Stores Reference was issued for the valve for each equipment that it was used in. Both of these run contrary to the whole principle of Stores Reference Number systems as mentioned earlier, so I'm sceptical.

There must surely be someone among the readership of *Radio Bygones* with past experience in stores administration in the British Army, who can explain the system for the benefit of all our readers.

Army No.	Stores Ref.	CV No. (or nearest equiv.)	Possible Commercial Substitute & *Notes*
Cathode ray tubes			
ACR1	ZC0123	1379	-
ACR2	-	(1379)	*2nd grade ACR1*
ACR2X	ZC0697	1380	-
ACR3	-	1386	-
ACR4	-	1387	-
ACR5	-	1388	-
ACR6	ZC0926	1389	-
ACR7	-	2745	4050AG
ACR8	ZC3081	1381	-
ACR10	ZC3141	1382	3223D
ACR11	ZC3595	1383	*ext. metallised ACR8*
ACR12	ZC1955	1384	-
ACR13	ZC3596	1385	-
ACR14	-	1390	-
ACR15	ZC13369	1391	-
ACR16	-	1392	-
ACR17	-	1393	-
ACR18	-	1394	-
ACR19	-	1395	-
ACR20	-	964	-
ACR21	ZC23359	1397	-
ACR22	-	252	-
ACR23	-	1398	-
ACR23(mod)	-	1399	-
Receiving triodes			
AR2	ZA7080	2838	-
AR4	ZA7100	1303	PM1HF, HL210, 210HF
AR5	ZA7112	1166	LP2, PM2A, P220
AR6	ZA6778	1304	LP2 *selected*
AR7	ZA6073	1109	HL133 (modified)
AR8	ZA7022	1306	HL23DD
AR9	ZA7021	1307	210LF, L21, L2, PM1LF
AR10	ZA7176	1308	L21DD, 210DDT, HD24, TDD2A
AR11	ZA5163	1655	4019B
AR12	ZA5165	1653	4020A
AR13	ZA5712	1664	4022AR
AR14	ZA6065	1312	220RC
AR15	ZA6066	1313	220LF
AR16	ZA6067	1032	220B
AR17	ZA7186	1037	MH4, AC/HL, 354V
AR20	ZA4329	1663	4021B
AR21	ZA3497	1055	EBC33
Diodes			
ARDD1	ZA7101	1300	10D1
ARD2	ZA5167	1078	D1
ARDD3	ZA7079	1301	D63, 6H6G
ARD4	ZA5169	1302	D42
ARDD5	ZA3056	1054	EB34
Receiving heptodes			
ARH1	ZA14980	1280	X64, 6L7G
Receiving pentodes			
ARP1	ZA7102	1118	PT2, Pen.220, PM22A
ARP2	ZA7074	1320	SP2
ARP3	ZA7103	1321	9D2
ARP4	ZA7075	1322	SP210
ARP5	ZA7113	1323	VP2
ARP6	ZA7008	1324	SP4
ARP7	ZA7076	1325	42MPT
ARP8	ZA6997	1326	AC4/Pen
ARP9	ZA6953	1327	Pen.1340(modified)
ARP9A	ZA2931	1328	7D8S
ARP10	ZA6085	1329	Pen.A4(modified)
ARP11	ZA6086	1330	TSP4
ARP12	ZA7073	1331	VP23
ARP12T	ZA7023/T	2841	-
ARP13	ZA7243	1332	VP210
ARP14	ZA4333	1333	220IPT
ARP15	ZA6981	1195	KTW63, 6K7G
ARP16	ZA6982	1074	KTZ63, 6J7G
ARP17	ZA6983	1186	KT63, 6F6G
ARP18	ZA6772	1334	KT24
ARP19	ZA5171	1335	SP41
ARP20	ZA5173	1336	SP42
ARP21	ZA5304	1192	Z62
ARP22	ZA6843	1337	116/Pen
ARP23	ZA5174	1124	MS/Pen
ARP24	ZA6064	1338	220VPT
ARP25	ZA5175	1181	KT61(modified)
ARP26	ZA5176	1340	KT44(modified)
ARP33	ZA21338	1341	MSP4
ARP34	ZA3493	1053	EF39
ARP35	ZA3058	1091	EF50
ARP36	ZA3796	1065	SP61
ARP37	ZA2938	1342	QP25
ARP38	ZA1879	1343	KTZ73(modified)
Receiving screen-grid			
ARS6	ZA7110	1317	S625
ARS7	ZA7114	1318	VS24, PM12M, S215VM
ARS8	ZA7115	1319	VS2, PM12V
Receiving triode-hexodes			
ARTH2	ZA2985	1347	ECH35
Receiving triode pentodes			
ARTP1	ZA7077	1344	TP22
ARTP2	ZA3062	1345	TP25
Transmitting triodes			
AT15	ZA7116	2845	-
AT16	ZA7117	2846	-
AT20	ZA7118	1361	MZ05-20
AT26	ZA7130	1360	-
AT35	ZA7153	1025	DET25
AT75	ZA5178	1222	ACT6
AT80	-	(25)	-
AT200A	ZA7136	2850	-
AT200B	ZA6126	1363	DET16
Transmitting pentodes			
ATP4	ZA5502	1366	V248A
ATP5	ZA6119	1367	V245
ATP7	ZA7084	1368	V226
ATP10	ZA5181	1369	4061A
ATP35	ZA7012	1370	PV1/35
ATP75	ZA7011	1371	PT6, PZ1/75, SW75PEN
ATP100	ZA5189	1372	4069A
ATP600	ZA7009	1373	PY3-600
Transmitting tetrodes			
ATS25	ZA3496	1374	5C250/A, 807
ATS25A	ZA10813	1364	*as ATS25, higher heater current*
ATS70	ZA7138	1365	4282B
ATS250	ZA7139	1031	

Army No.	Stores Ref.	CV No. (or nearest equiv.)	Possible Commercial Substitute & *Notes*
Rectifiers			
AU1	ZA7001	1264	U18, FW4/500
AU2	ZA7007	1349	RG5/500, RG4/1000
AU3	ZA7089	1064	U12/14, DW4/500
AU3A	ZA7189	1039	MU12/14, IW4/500, UU4
AU4	ZA5191	1113	U17
AU5	ZA5193	1111	E1132, V1907
AU6	ZA6999	1072	GU50, RG1-240, MU4250
AU7	ZA8996	1355	ESU300, RG3/1250, 4049C
AU8	ZA5198	1356	U22
AU12	ZA3495	1266	U15, RZ1-250
AU13	-	(1863)	

Army No.	Stores Ref.	CV No. (or nearest equiv.)	Possible Commercial Substitute & *Notes*
Indicators/Stabilisers			
AW1	ZA7200	1358	*neon indicator*
AW2	ZA7119	1070	7475
AW3	ZA7013	1110	S.130
AW4	ZA6961	1068	STV.280/40
AW5	ZA6076	1359	ME41
AW6	ZA1880	1077	EM31

Royal Air Force

Old Store Reference numbers in the RAF (Air Ministry) system mostly consist of the prefix '10E/' followed by a number of between one and five digits.

Some later valves were instead assigned numbers prefixed '10CV/' followed by the relevant CV number.

The prefix '110E/' was also used, allocated to valves and tubes bearing type numbers in the US RMA systems for receiving and special-purpose valves (see *RB* No. 9).

RAF No	Stores Ref. 10E/...	CV No. (nearest equiv.)	Possible Commercial Substitute & *Notes*
Cathode ray tubes			
VCR84	10	1084	4407
VCR85	11	1085	4605
VCR86	12	1086	4502
VCR87	13	1087	14L, 4410
VCR97	222	1097	4201, 4/6
VCR112	171	1112	V.1026
VCR131	156	1131	41DS
VCR131A	-	1548	
VCR138	407	1138	4203, 4/3
VCR138A	759	1587	
VCR139A	466	1588	23D, 4101
VCR140	420	1140	
VCR511	586	1511	4608
VCR511A	786	1589	
VCR511B	808	1590	
VCR511C	-	1549	
VCR514	658	1514	9R.TEB
VCR515	13026	1515	MX1
VCR516	13027	1516	
VCR516A	841	262	
VCR517	758	1517	
VCR517A	811	1591	
VCR517B	818	1592	
VCR517C	819	1593	
VCR517D	831	1594	
VCR517E	840	1595	
VCR518	767	1518	
VCR518A	810	1596	
VCR519	768	1519	
VCR520	771	1520	
VCR521	796	1521	

RAF No	Stores Ref. 10E/...	CV No. (nearest equiv.)	Possible Commercial Substitute & *Notes*
Cathode ray tubes (continued)			
VCR522	797	1522	
VCR522A	832	1597	
VCR522B	-	(335)	
VCR522C	-	(336)	
VCR523	798	1523	
VCR524	816	1524	
VCR524A		1547	
VCR525	817	1525	
VCR526	824	1526	
VCR527	826	1527	
VCR528	828	1528	
VCR529	835	1529	
VCR530	837	1530	
VCR531	-	1531	
VCR532	-	1532	
VCR533	-	1533	
VCRX156	-	300	
VCRX166	-	282	
VCRX190	-	376	
VCRX210	-	389	
VCRX244	-	390	
VCRX245	-	396	
VCRX246	-	401	
VCRX247	-	400	
Gas-filled triodes			
VGT121	164	1121	T41
VGT121A	630	1585	
VGT128	15	1128	GT1C
Indicators			
VI77	11539	1077	EM31
VI103	305	1103	Y63
VI132	6	1132	*neon indicator*
VI507	467	1507	*gas-filled spark gap*
Receiving valves			
VR17	7232	1017	
VR18	7607	1018	215SG
VR19	7846	1019	215P
VR21	7738	1021	210LF
VR22	7958	1022	220PA
VR27	8239	1027	*selected VR21*
VR28	8399	1028	220VSG

RAF No	Stores Ref. 10E/...	CV No. (nearest equiv.)	Possible Commercial Substitute & *Notes*
Receiving valves (continued)			
VR32	9141	1032	220B
VR35	9779	1035	QP21
VR37	9598	1037	MH4
VR38	9599	1038	MHL4
VR40	9601	1040	PP5/400
VR41	9049	1041	PM12M
VR43	10541	1043	210PG
VR44	10542	1044	HL21DD
VR49	10931	1049	210SPT
VR53	11399	1053	EF39
VR54	11400	1054	EB34
VR55	11401	1055	EBC33
VR56	11402	1056	EF36
VR57	11403	1057	EK32
VR57A	609	1570	*VR57, different test spec.*
VR59	11452	1059	955, HA2, 4671
VR65	11446	1065	SP61
VR65A	149	1574	SP41
VR66	11447	1066	P61
VR67	11448	1067	L63, 6J5G
VR78	11540	1078	D1
VR82	4	1082	220TH
VR83	5	1083	210VPT
VR91	92	1091	EF50
VR91A	287	1578	*VR91 selected for 'tail'*
VR92	105	1092	EA50
VR95	95	1095	954, ZA2, 4672
VR95A	286	1579	*VR95 to closer tolerances*
VR99	1277	1099	X66
VR99A	757	1581	
VR100	278	1100	KTW62
VR101	280	1101	MHLD6
VR102	279	1102	BL63
VR106	11095	1106	9D2
VR106A	821	1598	
VR107	11097	1107	15D2
VR108	11096	1108	8D2
VR108A	822	1599	
VR109	11098	1109	4D1
VR109A	823	1000	
VR116	266	1116	V872
VR117	176	1117	41MTL(MET)
VR117A	625	1584	*VR117 selected by HV test*
VR118	88	1118	KT2
VR119	28	1119	DDL4
VR122	31	1122	41MXP
VR123	-	1123	
VR124	24	1124	MS/PEN
VR125	25	1125	MS/PEN.B
VR126	172	1126	4SH
VR129	307	1129	MS/PEN
VR130	159	1130	HL23
VR130A	752	1586	
VR135	392	1135	E1148
VR136	386	1136	RL7
VR137	394	1137	RL16
VR502	312	1502	KT32
VR503	382	1503	KT33C
VR505	631	1505	MH41
Stabilisers			
VS68	11449	1068	STV280/40
VS69	11450	1069	STV280/80
VS70	11451	1070	7475
VS110	10914	1110	S.130
VS110A	423	1582	*selected VS110*

RAF No	Stores Ref. 10E/...	CV No. (nearest equiv.)	Possible Commercial Substitute & *Notes*
Transmitting valves			
VT4B	5203	1553	
VT20	7813	1020	220P
VT23	8062	1023	230XP
VT23A	521	1565	*selected VT23*
VT25	7312	1025	DET25
VT26	8185	1026	
VT26A	9122	1568	
VT30	8738	1030	
VT31	8739	1031	SG250
VT34	7787	1034	DET3
VT45	10557	1045	X56
VT46	10558	1046	PT25H
VT47	10559	1047	TZ05-20, VLS417
VT50	10945	1050	HL2K
VT51	10946	1051	PEN220A
VT52	11398	1052	EL32
VT58	11405	1058	
VT58A	410	1571	
VT60	11441	1060	807
VT60A	587	1572	807 *VT60 to wider tolerances*
VT61	11442	1061	RK34, DET19, 4074A
VT61A	142	1573	TV03-10
VT62	11443	1062	DET12, 834, TY1-50
VT73	11531	1073	H63, 6F5G
VT74	11532	1074	KTZ63, 6J7G
VT75	11533	1075	KT66
VT75A	387	1576	KT44T
VT75B	472	1577	KT44
VT76	11534	1076	TZ40, DA41
VT79	11752	1079	KT8
VT80	11756	1080	4307A
VT81	3	1081	4052A
VT82	4	-	220TH
VT88	9	1088	832
VT89	78	1089	
VT90	97	1090	
VT93	107	1093	
VT94	108	1094	
VT96	147	1096	5B/502A
VT98	224	1098	
VT98A	740	1580	
VT104	215	1104	PT15
VT105	216	1105	ML6
VT114	168	1114	
VT114A	567	1583	
VT127	231	1127	PEN.46
VT501	389	1501	E1192
VT501A	784	1002	
VT506	457	1506	5C/450A
VT509	-	(62)	
VT510	572	1510	
VT513	-	(44)	
Rectifiers			
VU7A	5433	1556	
VU29	8087	1029	
VU33	9829	1033	
VU39	9600	1039	U12/14, UU5
VU39A	574	1569	
VU64	11445	1064	U12/14
VU71	11529	1071	U52, 5U4G
VU71A	597	-	U52, 5U4G
VU72	11530	1072	GU5, GU50
VU111	146	1111	V1907
VU113	19	1113	U17

RAF No.	Stores Ref. 10E/...	CV No. (nearest equiv.)	Possible Commercial Substitute & *Notes*
Rectifiers (continued)			
VU120	121	1120	SU2150A
VU133	211	1133	V960
VU134	100	1134	HVR2
VU504	150	1504	V1901
VU508	520	1508	V1913
Special			
VW36	9851	1036	*VR22 selected for capacitances*
VW42	10299	1042	*VR27 selected for capacitances*
VW48	10585	1048	*VR18 selected for capacitances*

References

The tables in the preceding pages were compiled from information contained in the *CV Register of Electronic Valves*, AP.1186V, January 1946 with corrections and amendments to April 1949; *The Services Radio Valve Manual*, BR.783, November 1942; *Services List of Preferred Valves*, June 1950; *International Radio Tube Encyclopædia*, published by Bernards (publishers) Ltd, 1949.

Cross-Index of US Army VT-Numbers and Commercial Identifiers

This article was first published in the October 1990 issue of The *Old Timer's Bulletin*, official journal of the Antique Wireless Association, Inc., of America, and is reproduced here by kind permission, with additional data taken from the British *CV Register of Electronic Valves*.

Tube collectors and restorers of early military equipment have a continuing need for a reference source on US Army VT-numbered tubes. The following list attempts to provide more depth of coverage than the usual cross-reference chart. It combines locally available references with material kindly supplied by Bro. Pat Dowd W2GK; Bill Smith N9TT; and John Walker. Three specific sources were MIL-HDBK-213A, *Military Handbook – Electron Tubes – Cross Index and Type Identification*, 1963; NavShips 900119, *Cross Index of Electron Tube Types*, 1946; and the RSGB *Service Valve Equivalents*, 1947. Comments have been added to identify some of the more obscure items. The list has been cross-checked for errors.

A few of these tubes, for example the 'special' VT-155, 156, and 159, remain a mystery. Some of these must have been highly secret at the time, like the subminiature tubes in the then-classified variable-time (VT) artillery fuze, the one based on a small radar. Others may have simply been items that never went into substantial production. Yet other numbers (VT-32, for example) were cancelled. Reader inputs on the 'special' VTs are welcome!

Receiving tubes with a 'Y' suffix (e. g., VT-132/12K8Y) have low-loss base material. Full information on most of the items not otherwise explained can be found in the tube listings in any ARRL *Radio Amateur's Handbook* of 1945–52 vintage.

The list includes, inside square brackets, the British CV (Common Valve) numbers that were assigned to most of these items. A warning: CV-numbers are not unique: several such numbers may apply to a given tube. Also be warned that there were Royal Air Force VTs (Valve, Transmitting) that were totally unrelated to US tubes of the same VT-numbers: the VT20, VT25, VT45 ... up through VT510.

The informed observer can detect clusters of VT-numbers that must have been added to accommodate specific new sets of equipment: VT-65, -66, and 86–88, for the BC-312 receiver (in the SCR-177B and related sets); the VT-131 through 139, for the BC-45x (SCR-274N) aircraft gear, c.1940; the VT-171 through VT-174, for the BC-611 (SCR-536) handi-talkie and BC-745 (SCR-511) 'pogo stick' transceiver. Other likely clusters: the VT-177 to 179, 182, 183, and 185, for the BC-620 (SCR-509 et al.) 'jeep radio'; or the VT-188 through 191, for the BC-645 (SCR-515) IFF set, c.1941. Some types are traceable to early Army radars of 1937-40.

A final note: the speed with which military electronics developed as WWII drew closer can be seen in this list. It took about 33 years (1917 to c.1940) for the first half of the list (VT-1 to VT-140, say) to develop. The second half required only about 2½ years more (c.1940 to c.1943). At that point the Army gave up its special numbering system in favour of the Joint Army-Navy (JAN) prefix system for regular civilian type numbers.

Some of the civilian type numbers for transmitting tubes reflect specific manufacturers. For reference purposes, letter prefixes used (over the time span of the VT-types and later) were as follows:

Amperex: A, CEP, HF, P, and ZB
Bomac Labs: BL (on experimental types)
Continental Electric: CE
Dumont: B, K (experimental)
Eitel-McCullough: RX, UH, and numbers like 100TH or 304TL
Electronic Enterprises: EE
Electrons Inc.: EL
Federal Telephone and Radio: F
General Electric: FA, FG, FJ, FP, FR, GL, NE, PJ, PR, and PT (Z, ZP, and ZG on experimentals)
Heintz and Kaufman: HK
Hytron: HY (D and HD on experimentals)
Machlett Labs: ML (EP on experimentals)
RCA: A, C, or R (on experimentals)
Raytheon: CK, RK, RKR, RM, and RX (QF, QG, QK, QL, QM, QMG, QT, and QY on experimentals, klystrons, etc.)
Sperry: SAC, SAL, SRC, SRL, and SRX (on experimentals and klystrons)
Sylvania: R (SB, SD, SN, and X on experimentals and special items)
Taylor: R, T, TT, TZ, and TW
Tung-Sol: DT (on experimentals)
United Electronics: BM, CV, CW, HV, UE, and UX (yes, UX!)
Varian Associates: VA (V on experimentals)
Western Electric: D, GA, and WE (XQ as a suffix on experimentals)
Westinghouse: DK1, DRJ, DRO, KU, KX, K1, RO, and WL (WX on experimentals)

US Army VT No.	Commercial Number [CV No.]
VT-1	WE 203A (Navy CW-933)
VT-2	WE 205B (Navy CW-931)
VT-3	None (WE)
VT-4A	WE 211A (Navy CW-1818)
VT-4B	211 (PR-11-A; WL-410; Navy CG-1984) and WE 211D (Navy CW-1818A)
VT-4C	211 [CV620]
VT-5	WE 215A (Navy CW-1344)
VT-6	WE 212A (Navy CW-1819)
VT-7	WX-12
VT-8	UV-204 (PR-4-A)
VT-10	GE 'P' (prototype of the UV-204), Navy CG-916
VT-11	GE 'G', Navy CG-890 (early version)
VT-12	GE 'T'
VT-13	GE 'G' ruggedized (prototype of the UV-201), Navy CG-890 (later version)
VT-14	GE 'T' (prototype of the UV-202), Navy CG-1162
VT-16	GE 'T' ruggedized
VT-17	860 (PT-860; WL-415) [CV640]
VT-18	GE 'U' (prototype of the UV-203), Navy CG-1144
VT-19	861 (PR-861; WL-407) [CV641]
VT-20	None (de Forest)
VT-21	None (de Forest)
VT-22	204A (PR-4-B; Navy CG-1860A) [CV2563]
VT-23	
VT-24	864 (FR-300; Navy 38064) [CV2675]
VT-25	10 (PT-10-A) [CV603]
VT-25A	10Y
VT-26	22
VT-27	30 [CV604]
VT-28	24; 24A [CV936]
VT-29	27 [CV944]
VT-30	01A (PR-1-B; Navy SE-4374) [CV750]
VT-31	31 [CV947]
VT-33	33 [CV949]
VT-34	207 (Navy CG-1971)
VT-35	35/51 [CV1752]
VT-36	36 [CV1775]
VT-37	37 [CV606]
VT-38	38 [CV712]
VT-39	869 (PJ-26; Navy SE-3071)
VT-39A	869A [CV2723]
VT-40	40 [CV2501]
VT-41	851 (PR-51-A; Navy CG-2172) [CV2671]
VT-42	872 (FG-19; Navy SE-3070) [CV642]
VT-42A	872A special filament
VT-43	845 (WL-412) [CV735]
VT-44	32 [CV711]
VT-45	45 [CV596]
VT-46	866 (PJ-28; Navy SE-3069) [CV32]
VT-46A	866A
VT-47	47 [CV1772]
VT-48	41 [CV608]
VT-49	39/44 [CV1771]
VT-50	50 [CV2533]
VT-51	841
VT-52	45 special
VT-53	(replaced by VT-42A)
VT-54	34 [CV1751]
VT-55	865 (PJ-27; Navy SE-3294) [CV2676]
VT-56	56 [CV611]
VT-57	57 [CV612]
VT-58	58 [CV613]
VT-59	59 [CV2538]
VT-60	850
VT-62	801/801A [CV621]
VT-63	46 [CV2531]
VT-64	800 [CV2657]
VT-65	6C5 [CV582]
VT-65A	6C5G [CV581]
VT-66	6F6 [CV1186]
VT-66A	6F6G [CV1911]
VT-67	30 (porcelain base)
VT-68	6B7 [CV1891]
VT-69	6D6 [CV1900]
VT-70	6F7 [CV1915]
VT-72	842
VT-73	843 [CV639]
VT-74	5Z4 [CV1864]
VT-75	75 [CV614]
VT-76	76 [CV615]
VT-77	77 [CV616]
VT-78	78 [CV2544]
VT-80	80 [CV617]
VT-83	83 [CV618]
VT-84	84/6Z4 [CV619]
VT-86	6K7 [CV1942]
VT-86A	6K7G [CV1941]
VT-86B	6K7GT [CV1943]
VT-87	6L7 [CV1951]
VT-87A	6L7G [CV1950]
VT-88	6R7 [CV1963]
VT-88A	6R7G [CV1962]
VT-88B	6R7GT [CV1964]
VT-89	89 [CV833]
VT-90	6H6 [CV1301]
VT-90A	6H6GT [CV1931]
VT-91	6J7 [CV1074]
VT-91A	6J7GT [CV1937]
VT-92	6Q7 [CV588]
VT-92A	6Q7G [CV587]
VT-93	6B8 [CV1894]
VT-93A	6B8G [CV1893]
VT-94	6J5 [CV1067]
VT-94A	6J5G [CV1932]
VT-94B	6J5 selected
VT-94C	6J5G selected
VT-94D	6J5GT [CV1934]
VT-95	2A3 [CV1831]
VT-96	6N7 [CV1957]
VT-96B	6N7 selected
VT-97	5W4 [CV1849]
VT-98	6U5/6G5 [CV504]
VT-99	6F8G [CV1917]
VT-100	807 [CV124]
VT-100A	807 modified
VT-101	837 [CV637]
VT-103	6SQ7 [CV1990]
VT-104	12SQ7 [CV546]
VT-105	6SC7 [CV1969]
VT-106	803 [CV623]
VT-107	6V6 [CV510]
VT-107A	6V6GT [CV511]
VT-107B	6V6G [CV509]
VT-108	450TH
VT-109	2051 [CV1798]
VT-111	5BP4; 1802P4 [CV836]
VT-112	6AC7/1852 [CV660]
VT-114	5T4 [CV1846]
VT-115	6L6 [CV1948]
VT-115A	6L6G [CV1947]
VT-116	6SJ7 [CV591]
VT-116A	6SJ7GT [CV592]
VT-116B	6SJ7Y [CV866]
VT-117	6SK7 [CV1981]
VT-117A	6SK7GT [CV1982]
VT-118	832 [CV634]
VT-119	2X2/879 [CV597]
VT-120	954 [CV1095]
VT-121	955 [CV1059]
VT-122	WL-530; GL-530
VT-123	RCA A-5586 (replaced by VT-128)
VT-124	1A5GT [CV756]
VT-125	1C5GT [CV1805]
VT-126	6X5 [CV573]
VT-126A	6X5G [CV572]
VT-126B	6X5GT [CV574]
VT-127	100S
VT-127A	100TS; WL-534; 534; 3-100D2
VT-128	1630 (A-5588A) [CV2715]
VT-129	304TL
VT-130	250TL
VT-131	12SK7 [CV543]
VT-132	12K8Y [CV703]
VT-133	12SR7 [CV700]
VT-134	12A6 [CV525]
VT-135	12J5GT [CV535]
VT-135A	12J5 [CV534]
VT-136	1625 (12V, 7-pin 807) [CV659]
VT-137	1626 (12V triode intended for stable VFOs) [CV1755]
VT-138	1629 (12V, octal-based 6E5) [CV1756]
VT-139	0D3/VR-150 [CV216]
VT-140	1628
VT-141	WL-531
VT-142	WE 39DY1 (doorknob)
VT-143	805 [CV625]
VT-144	813 [CV26]
VT-145	5Z3 [CV1861]
VT-146	1N5GT [CV1823]
VT-147	1A7GT [CV1802]
VT-148	1D8GT [CV1811]
VT-149	3A8GT
VT-150	6SA7 [CV1966]
VT-150A	6SA7GT [CV1967]
VT-151	6A8G [CV578]
VT-151B	6A8GT [CV580]
VT-152	6K6GT [CV1940]
VT-152A	6K6G [CV1938]
VT-153	12C8Y [CV837]
VT-154	814 [CV629]
VT-155 to 157	'Special'
VT-158	'Special' (Zahl 600MHz oscillator)

US Army VT No.	Commercial Number [CV No.]
VT-159 to 160	'Special'
VT-161	12SA7 [CV537]
VT-162	12SJ7 [CV697]
VT-163	6C8G [CV1896]
VT-164	1619 (2.5V filament-type 6L6) [CV723]
VT-165	1624 (2.5V filament-type 807)
VT-166	WE 371A
VT-167	6K8 [CV1945]
VT-167A	6K8G [CV1944]
VT-168A	6Y6G [CV515]
VT-169	12C8 [CV531]
VT-170	1E5GP [CV766]
VT-171	1R5 [CV782]
VT-171A	(Loctal version of 1R5)
VT-172	1S5 [CV784]
VT-173	1T4 [CV785]
VT-174	3S4 [CV820]
VT-175	1613 (like 6F6) [CV655]
VT-176	6AB7/1853 [CV1873]
VT-177	1LH4 [CV780]
VT-178	1LC6 [CV778]
VT-179	1LN5 [CV781]
VT-180	3LF4
VT-181	7Z4 [CV1790]
VT-182	3B7/1291 [CV811]
VT-183	1R4/1294 [CV2709]
VT-184	0B3/VR-90 [CV3799]
VT-185	3D6/1299 [CV815]
VT-186	'Special'
VT-187	575A/975A/UE975A/ F375A/GL512A/WL575A/AM575A/ EE575A/512/375A (not WE 375A!) (mercury transmitting rectifier)
VT-188	7E6 [CV891]
VT-189	7F7 [CV893]
VT-190	7H7 [CV895]
VT-191	WE 316A (doorknob) [CV683]
VT-192	7A4 [CV1770]
VT-193	7C7 [CV1777]
VT-194	7J7 [CV897]
VT-195	1005/CK1005 [CV2874]
VT-196	6W5G [CV574]
VT-197A	5Y3GT/G [CV1268]
VT-198A	6G6G [CV1926]
VT-199	6SS7 [CV1993]
VT-200	0C3/VR-105 [CV686]
VT-201	25L6 [CV552]
VT-201C	25L6GT [CV553]
VT-202	9002 [CV664]
VT-203	9003 [CV665]
VT-204	HK24G; 3C24; 3-25D3 [CV789]
VT-205	6ST7 [CV1996]
VT-206A	5V4G [CV729]
VT-207	12AH7GT [CV529]
VT-208	7B8
VT-209	12SG7 [CV694]
VT-210	1S4 [CV783]
VT-211	6SG7 [CV1978]
VT-212	958 [CV650]
VT-213A	6L5G [CV862]
VT-214	12H6 [CV916]
VT-215	6E5 [CV1906]
VT-216	816 [CV724]
VT-217	811 [CV628]
VT-218	100TH [CV2552]
VT-220	250TH; 3-250A3 [CV2589]
VT-221	3Q5GT [CV819]
VT-222	884 [CV647]
VT-223	1H5GT [CV1820]
VT-224	2C34/RK34 [CV18]
VT-225	WE 307A; RK75 [CV2612]
VT-226	3EP1; 1806P1 [CV817]
VT-227	7187; KR7187 (pentode similar to 6V6)
VT-228	8012 [CV662]
VT-229	6SL7GT [CV1985]
VT-230	WE 350A [CV2629]
VT-231	6SN7GT [CV1988]
VT-232	E-1148 (British 3.5W UHF transmitting triode) [CV6]
VT-233	6SR7 [CV867]
VT-234	HY-114B [CV3505]
VT-235	HY-615 [CV3506]
VT-236	836 [CV636]
VT-237	957 [CV2700]
VT-238	956 [CV649]
VT-239	1LE3
VT-240	WE 710A; 8011 [CV46]
VT-241	7E5/1201 [CV2704]
VT-243	7C4/1203A [CV2705]
VT-244	5U4G [CV575]
VT-245	2050 [CV2565]
VT-246	918; CE-1 [CV2692]
VT-247	6AG7 [CV1882]
VT-248	3CP1; 1808P1
VT-249	1006; CK1006
VT-250	EF50 (9-pin British 'Loctal-style' pentode, metal can) [CV1091]
VT-251	WL-441 (GL-441 phototube?)
VT-252	923; CE-23
VT-254	304TH; 3-300A3 [CV2611]
VT-255	WE 705A; RK-705A; 8021 [CV3587]
VT-256	GL-486/ZP486
VT-257	K-7/2J30 (magnetron)
VT-259	829 [CV2666]
VT-260	0A3/VR-75 [CV3798]
VT-264	3Q4 [CV818]
VT-266	1616 (2B26) [CV2679]
VT-267	WL-578 (578; 2-100A; 100R; 100A; 451; GL451; ZP451; 8020; EE8020; GL8020) (xmitting vacuum rectifier) [CV2967]
VT-268	12SC7 [CV540]
VT-269	WE 717A [CV3594]
VT-277	417; WL417; WL417A (not the WE 417A/5842!) (klystron)
VT-279	GY-2 (D-161-83; 1278-GY2) (thyratron)
VT-280	C7063 (1P24; RCA 936; 516; GL-516; ZP516 (vacuum phototube)
VT-281	HY-145ZT (HY-115)
VT-282	ZG489 (thyratron)
VT-283	QF-206; 2E27 (subminiature pentode)
VT-284	QF-197; 2B24 (subminiature filament-type diode)
VT-285	QF-200C; 2C27 (subminiature triode)
VT-286	832A [CV1088]
VT-287	815 [CV2663]
VT-288	12SH7 [CV922]
VT-289	12SL7GT [CV924]

In the next issue of

RADIO BYGONES

Due out May 28

Photo-feature and articles – Test Equipment

The Mysterious A. J. Alan

A Spark of Nostalgia

Radio Valves & Tubes Part 3 – CV Equivalents

Contents subject to last-minute revision

The Vintage Years of Amateur Wireless

Part 8

by Stan Crabtree G3OXC

The use of wireless as a control system for models came to light in an article by J. S. Pettman, published in a July 1910 edition of the *Model Engineer*. This was of course a natural extension of the leisure activities of the many Edwardian model makers with a knowledge of electricity and an urge to experiment with wireless telegraphy. The article described in detail the construction of what was termed a model torpedo boat (but what we might well consider to be a 4-funnelled battleship) which had its movement controlled by wireless.

The model ship is shown in **Fig. 1**. The length of the vessel was 62in, it had a beam of 7in, a maximum depth of 6in and was propelled by an electric motor at 5 knots. The apparatus on board consisted of a coherer, a Siemens polarised relay, decoherer, numerous switches and relay cut outs, steering motor, four driving motors and a set of 6 volt 30 ampere-hour (Ah) accumulators. On land the controlling station was made up of a 4in spark coil, oscillator and spark gap, an antenna and a set of 8 volt 60Ah accumulators.

As might be expected, all initial experiments were carried out at home. During this period a smaller transmitting coil was used and energised by a 4 volt accumulator. Only when it was certain that all the mechanisms were actuated correctly did the constructor venture out on the water with his model.

The use of a coherer as a detector appeared to be a good choice in this case as no Morse signalling was involved, merely the need to receive the required number of dashes in order to switch on a particular motor or solenoid. However, the author pointed out that he soon discovered that sensitivity was lost due to oxidation of the coherer's filings and he would recommend the use of an electrolytic type to anyone thinking of copying his design.

Some switching was achieved by mercury in cups. Decohering was obtained at the optimum time by relay delay circuits. Operation was controlled by a series of wave transmissions in the form of dashes: The first started the motor, the second reversed the driving motor, the third cut the current of the reversal solenoid, the fourth ran the motors ahead. Further controls accounted for other functions until the ninth wave which 'cuts current off the motor, causing the rudder to fly back to the mid-position.' Not quite up to a present-day servo system perhaps but a well thought out approach for 1910.

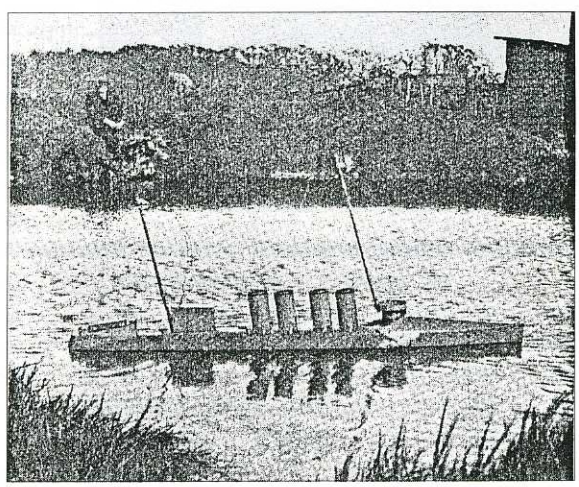


Fig. 1 - Mr Pettman's wireless controlled model at rest in a local pond. The aerial was a twin wire array, supported between two masts and similar to aerials on ocean-going vessels at this time

A realistic circuit for producing wireless telephony by means of a water-cooled arc is shown in **Fig. 2** and was described by 'AB' (Edinburgh) in the 7 July 1910 issue of the *Model Engineer*. The transmitting aerial consisted of four wires each 110ft long and erected at 50ft. The earth 'comprises all the water and gas pipes connected to a yard square copper plate sunk 6' in damp soil.' However, even with a 100ft long wire erected at a height of 60ft radiating to a receiver one mile away, his operation was unsuccessful. The glow lamp in the earth circuit of the transmitter aerial coupling coil would not light.

The editor came immediately to the rescue. He felt that the trouble was undoubtedly the fact that 'AB' was using AC to drive the circuit when DC was required across the arc. Using DC he said he felt sure 'AB' would observe a significant glow in the indicating lamp.

The scene for wireless amateurs in Australia at this time came to light when the editor of the *Model Engineer* thought fit to comment on a letter he had received. It painted a rather dismal picture of budding experimenters at one of the furthest posts of the Empire with a limited supply of electrical components. In particular a complaint was aired that many so called reputable UK suppliers were not taking mail order from this then Colony seriously and inclined to send 'a size too big or a size too small' to their customers. The correspondent also mentioned he had been in communication with the Australian PMG for 17 months about a licence and understood if it was granted he would have to pay a royalty of 3 guineas a year. This, he thought, was 'pretty stiff.' His station consisted of a 13in coil, three-point spark gap and an oscillator battery of six Leyden jars. The receiver used an electrolytic detector. All the equipment had been home constructed and with seven strands of aerial each 38ft long and 70ft high it was expected a range of 50 miles would be achieved. He was naturally frustrated as due to the strict laws in force in the granting of licences he had not been able to use his equipment at the time of writing. A friend had apparently told him his apparatus 'was far better and more up to date' than many of the outlying stations of a well-known telegraph company. He concluded: 'I feel proud of it because it shows we amateurs can show that we are just as capable as a lot of professional men at our own particular hobby.'

In a July 1910 issue of the *English Mechanic & World of Science*, a

correspondent 'C' announced he intended to build a 4in or 6in spark coil and wanted to start a reversible electric motor by Hertzian waves from a distance. How could he make a reversing switch?

A. E. R. Bottone responded with: 'You seem to be seeking information not easily obtainable.' He went on to say: 'I believe the Government has torpedoes steerable by wireless telegraphy and also an airship. Others, like you, would be interested in how to do this.' He ended by saying he was, in fact, working on a similar device at present but not yet in a position to give parts.

The *English Mechanic* printed a letter in August 1910 from a correspondent in Victoria, British Columbia, who seemed to think the nearest receiving station absorbed the most energy from a distant transmitter and was prepared to argue about it. It took a lengthy discourse on the rudiments of radiation and propagation from the irrepressible W. J. Shaw of Twickenham to put him right.

A correspondent in a September issue of the *English Mechanic* signing himself 'Sign Experm' called for some practical information. He wanted to know where he could get to know the various calls and signals used in wireless telegraphy. From a book perhaps? A. E. R. Bottone recommended his late father's original book *Wireless Telegraphy and Hertzian Waves* and also his translation of Italian D. Mazzotto's work on the subject. In fact these were by now almost obsolete having been superseded by more modern publications. T. W. Shaw chipped in to suggest Dr Fleming's *Principles of Radiotelegraphy* at the then rather expensive price of 24s (£1.20).

Many present-day amateurs would undoubtedly envy the problem of 'HRW' (Colchester). Writing in the *Model Engineer* in September 1910 he described his antenna arrangement as having four cylinders, each consisting of a group of four single 16-gauge hard-drawn copper wires. The average length of the cylinders was 35 yards and they were connected together and suspended from a mast 123 feet high. His earth system was almost a textbook design and consisted of six single galvanised-iron wires spreading out fanwise under the turf and within the area covered by the aerial.

He started out by saying the capacity of the aerial was considerable (!) and he was obliged to place a capacity of 0.0005 microfarad in series to tune down to 900metres (333kHz). He also had 'large amount' of inductance in the primary of the Tesla coil. His problem was that 'my aerial seems to object so strongly to its capacity being cut down that it prefers to be out of tune.'

The editor felt he was suffering from harmonic resonance. The aerial plus the primary inductance had a natural time-period (frequency) equal to more than a 900m wave. He went on with a steady discourse to prove that tripling was taking place to 300m (1000kHz). He must have had a moment of indecision as he concluded: 'In the absence of further information of a contradictory character, this theory would seem to be the most likely one'. The remedy, he added, was to reduce the turns of the primary winding on the Tesla coil.

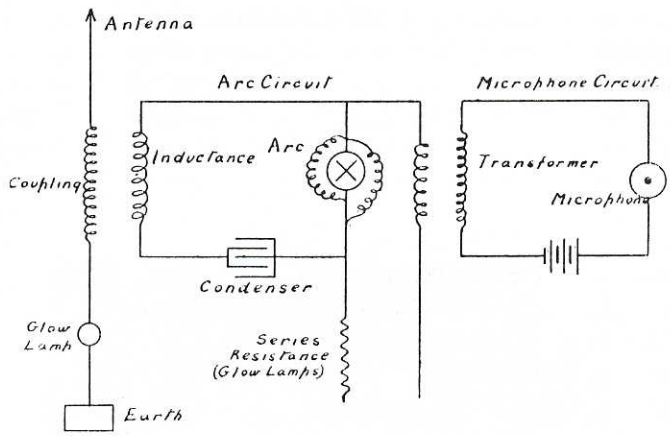


Fig. 2 - A circuit for producing wireless telephony by means of a water-cooled arc

A letter from 'SAF' (Liscard) appearing in the *Model Engineer* in October 1910 seemed to indicate the forerunner of a marine satellite antenna! He wrote to say that he had seen a destroyer in the River Mersey with 'knob-like arrangements' on the wireless antenna. He was told that these knobs were for 'catching the wireless waves more easily' and wanted to know 'of what these knobs are composed?'

The editor explained that what he had observed were undoubtedly insulators for supporting the aerial. They were often called 'globe strain' insulators and being nearly spherical would look like knobs. He doubted whether employing them on a typical experimenter's small apparatus would improve the performance.

'HB' (Peterborough), writing in the same issue asked for details on the construction of a telephone receiver. With the now general use of the electrolytic and crystal detector, a pair of high impedance telephones were essential for the increased sensitivity available.

The editor said that it was possible to obtain 2000Ω resistance on the two bobbins of an ordinary receiver if the correspondent was to 'wind very carefully with No. 48 SWG single silk-covered copper wire.'

A. E. R. Bottone made another attempt to clear the redundant coherers gathering dust in his store in November 1910. Writing in the *English Mechanic & World of Science*, 'SA' wanted someone to recommend a good detector and also a book on the subject of wireless. Correspondent 'Hyde Park' suggested the updated work by Howgrave-Graham which was now available at 2s. (10p). Bottone revealed once again his now familiar love affair with the coherer and stated 'you can't improve on a good filings coherer.' To qualify this he came out with what nowadays would seem to be a rather strange observation: 'I know at present that everyone is in favour of an electrolytic detector – but this can only be used with a specially wound telephone and it is not always convenient to carry a telephone on one's head for several hours a day because it must be connected to an aerial and so one becomes akin to a dog on a chain.' I wonder if the growing breed of wireless operators that were to appear in the following years ever thought of themselves in this canine connection?

The wearing of headphones does not seem to be bothering the American amateur shown in **Fig. 3**. Photographed in the Autumn of 1910, in the suburbs of Philadelphia, his equipment is seen to be a pair of telephone receivers, a detector and tuning coil. He appears to be evaluating the respective merits of two systems: An external aerial with no earth connection compared to a 'top hat' antenna with the effectiveness of a manhole cover as a ground!

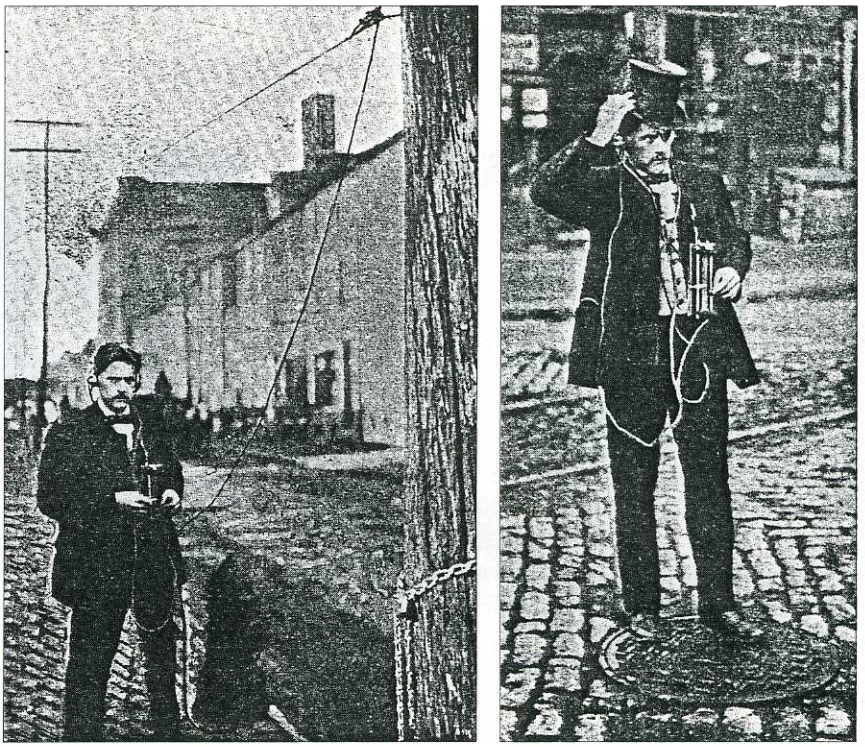
In the 17 November 1910 issue of the *Model Engineer* a letter from J. A. Walshaw confirmed a comment from Freeman Lee on transatlantic signals

(see *Radio Bygones No. 8*). He was answering a query from 'WF' (Lavender Hill) on reception apparatus and suggested only an electrolytic detector should be used 'with sulphuric acid about 1 to 4.'

Mr Walshaw appears to have had excellent results in Central Yorkshire from an aerial 90ft above ground, supported by a single pole erected on the roof of a building 50ft high. He could receive Paris at 8pm nightly 'very loud' and Norddeutsch between 10 and 11pm where he could 'catch every word with a single headgear telephone receiver.' At this time Norddeutsch was transmitting press traffic directed to the German liners on the North Atlantic run – messages that would be published in the shipboard morning newspapers.

Other notable stations heard by Mr Walshaw were Cullercoats 'quite intense and in constant operation', Cleethorpes (Naval) 'clearly heard with the telephone earpiece 12" away', Liverpool 'rather faint due to the intervening hills' and Heysham 'not at all for the same reason.' Scheveningen was copied clearly but not as strong as Norddeutsch. He also substantiated Freeman Lee's comments earlier in the year that transatlantic stations were coming in well, presumably Arlington Va., (NAA), Cape Cod (WCC), and of course the high powered Glace Bay transmitter in Nova Scotia in regular contact with the Marconi station at Clifden in Ireland. Mr Walshaw remarked that he was able to transmit over 100 miles but the chief drawback was the lack of other stations to experiment with. At this time there had apparently been no attempt to collate and publish a list of amateur station calls. The first was made by A. W. Gamage some two years later. *(Reproduced in* The Bright Sparks of Wireless *by G. R. Jessop, reviewed in* RB *No. 8 – Ed.)*

The station heard in Paris was 'FL' using the 300ft Eiffel Tower to support its aerial and the first to transmit wireless time signals earlier in the year. Built in 1889 for the Paris Exposition, the municipality had decided to dismantle it in 1910. But in the intermediary years its use as a wireless transmitter had become apparent due to the experiments carried out by Commandante Ferrie, Director of the French Military Wireless Service. Broadcasting time signals twice a day at 10am and midnight on 2500m (120kHz) its output could be heard all over Europe. Many amateurs were first attracted to wireless by hearing of 'FL' from friends. With the effective radiation of the transmitter and the use of an electrolytic or crystal detector it was comparatively easy to receive, even by a beginner. Listeners could also practice their Morse by copying the weather forecast and news items which were sent in French at 12wpm immediately after the time signals. ***RB***



An impromptu antenna Manhole as a ground

THE ELECTRO-MAGNETIC EAR

Fig. 3 - A Philadelphia amateur experiments with mobile wireless reception

Times, They Were a'Changing

By 1910, wireless was no longer quite the novelty that it had first been. The necessity for some framework of regulation had been fulfilled in the Wireless Telegraphy Act of 1904, and the idea of television – sending moving pictures by wireless – was already being pursued. Soon, a world war and the realisation of the need to improve the scope and reliability of communications in the field was to bring great strides in techniques.

Those first vintage years of amateur wireless were passing, and so I bring this series to an end. I hope that *Radio Bygones* readers have enjoyed reading about them as much as I've enjoyed researching and writing the articles.

Stan Crabtree

If you enjoy reading Radio Bygones, why not tell your friends about it too?

Seagoing Recollections

by Frank Bailey G3DZX (SK)

I became interested in wireless as we knew it in 1923. I was then 17 years old and lived in a small village in the Evesham area. At that time a weekly magazine called *Popular Wireless* was published, shortly to be followed by *Amateur Wireless* and *Modern Wireless*.

My interest was aroused by those publications, also by my only pal in the village. He was the son of the local garage owner and between us we built crystal receivers and later one-valve and two-valve sets.

In those days most of the spares for repairing cars were made at the garage, which had a good workshop complete with lathe and best of all a battery charger.

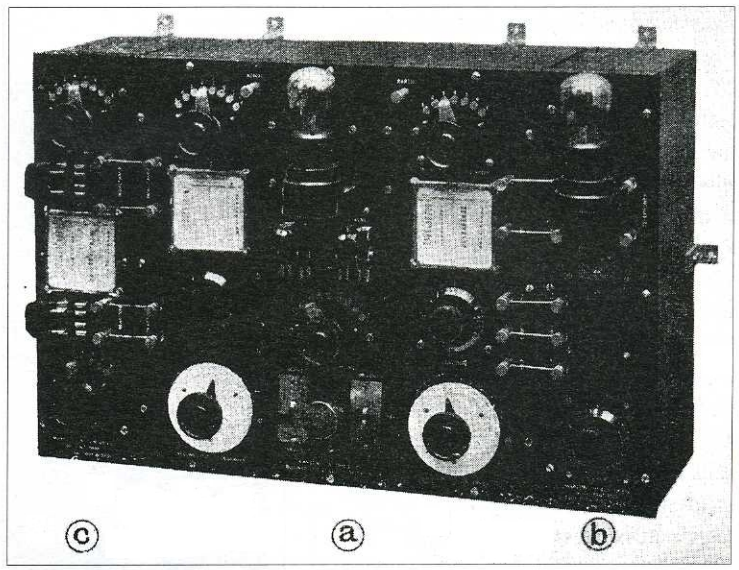
We bought our bits and pieces when we could afford them from Brown Brothers in Birmingham. Variable condensers could be obtained in kit form and having bought one such kit we set about making our own using tin-plate for the fixed and moving vanes and plywood for the end plates, and although we had no idea of their capacitance value they worked and that was the object. Coils were also wound on cardboard formers. Resistors were of what was then called the spaghetti type, and fixed condensers came from Dubilier. We did not solder the components together but attached them with brass nuts and bolts.

The old wire from the coil of Model T Ford car provided most of the wire for aerials, etc. Still we did receive the local BBC station 5LT in Birmingham, and lots of Morse.

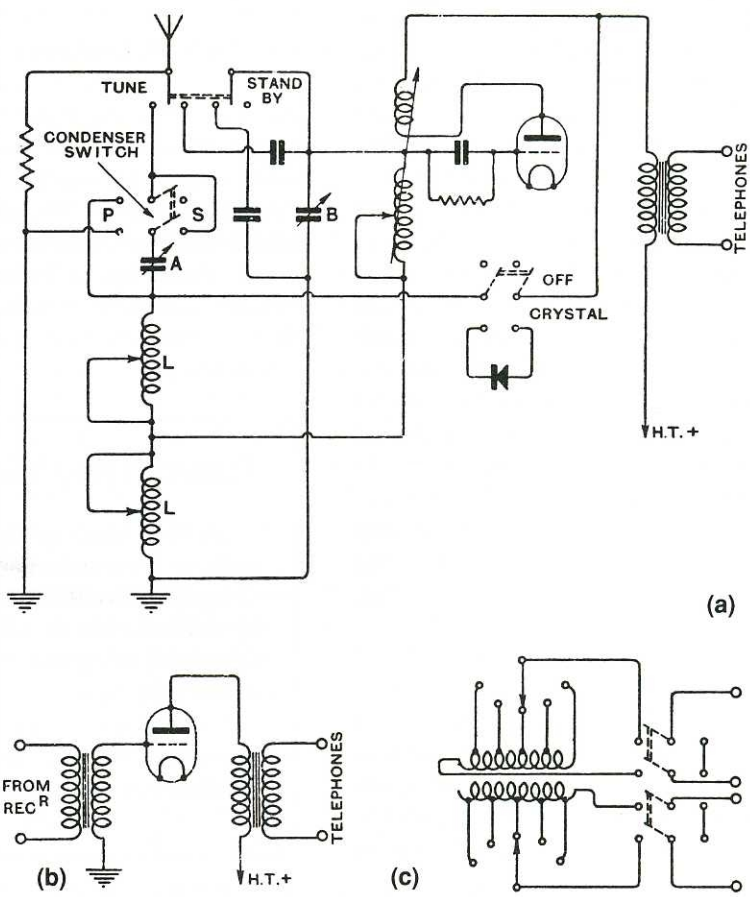
The village had little to offer in the way of interesting employment. I was casting around to find something in the electrical line when an advert in the local paper caught my eye. It was the Universal School of Wireless Telegraphy in Birmingham. They guaranteed employment by the Marconi Company at sea as wireless operators if one gained the PMG First Class Certificate. I made enquiries and joined the school in November 1926, the fee being £40 for a year's tuition.

At the school they had a Marconi 1½kW rotary spark transmitter, a 1½kW long-wave valved transmitter ('A-Panel' type) and the then-standard receiver the MR4b, which was a 2-valve TRF type. There were about thirty pupils and naturally we spent a lot of our time between lectures learning Morse.

I obtained my ticket in November 1927 after twelve months of hard slog. In December I joined the Marconi Company and on December 24 sailed for Australia in the Orient liner RMS *Orvieto* (callsign GLYJ, built 1909, 12 133 tons). She was fitted with identical transmitting equipment to that of the wireless school, but the receiver was a tuner with a local oscillator and



Marconi Marine Receiver No. MR4b, comprising (a) Receiver Type 226 covering 300–3000m, (b) Single note magnifier Type 227 and (c) Long-wave adaptor Type 229. Valve types used were V24, DEV, DER or R



The Long-wave adaptor connects in place of links across two pairs of terminals marked 'Reaction' and 'Inductance' in the Receiver Type 226, not shown in the above circuit diagram. The Single note magnifier Type 227 connects between the Receiver unit and headphones

an amplifier using seven 'Q' type valves. Business was fairly brisk with upwards of 800 passengers, and there was Press to copy from Rugby Radio GBR on 18 750 metres (16kc/s), also the same station broadcast private traffic to ships four times a day and a schedule had to be kept for that. All our long-distance traffic was sent on the long-wave transmitter, an old-fashioned set with no front panel – only a grille to protect the valves which would get red hot after quite a short period of transmitting. It had a range of about 3000 miles, so that Devizes Radio GKU was worked from as far afield as the Port Said area, just before entering the Suez Canal.

In January 1928 the Marconi Company joined up with the Radio Communication Company and from then on operators and equipment became a mixture. In the following March, I was transferred to the RMS *Orford*/GNRC, a new vessel fitted with RCC gear which was rather more modern in style than the old Marconi equipment. The long-wave transmitter was the T22, covering 600–800 metres ICW and 1800–2600m CW.

It is odd to think that these transmitters were not crystal controlled, the oscillator valve fixing the frequency. We did not have any form of wavemeter to check the wavelength. Now and then, shore stations would indicate to us that we were off frequency and would listen while we corrected it.

Also in January of that year, the Wireless Convention held in Washington USA made some changes, the main one of which was that the existing PMG 1st Class Certificate became a 2nd Class Certificate. Since it was necessary to hold a 1st Class ticket to be in charge on the larger ships, there was a rush to sit the examination to qualify for those positions. The exam consisted of Morse at 25 words per minute and a knowledge of some of the new regulations. I took my exam at the GPO in Cardiff without any trouble.

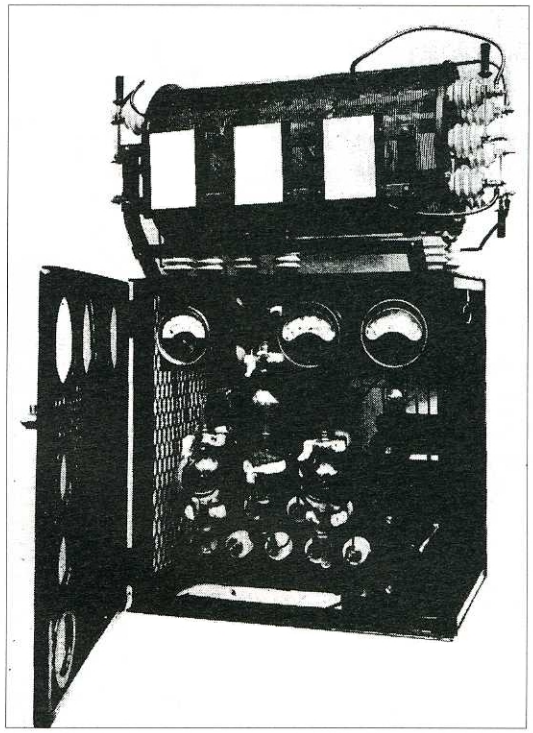
Between 1929 and 1942 I served in all kinds of ships, mostly cargo vessels. Short-wave receivers came in, but short-wave transmitters were only installed in the liners. We had spark transmitters, both rotary and quench gap types. It wasn't until 1942 that I was appointed to a ship with medium-wave and short-wave valved transmitters, also radio telephone; they took a bit of getting used to. Being war time, radio silence was the order of the day. However, this was a rescue ship run by the Admiralty and we were controlled by the escort ships in the convoys, and as such were permitted to transmit as and when necessary. It was a very interesting time.

In 1946, with the war over, I decided to come ashore and found employment with the Western Electric Company who at that time installed and serviced cinema sound equipment. Later on we got involved in other activities, including 'bleep' systems in hospitals, etc.

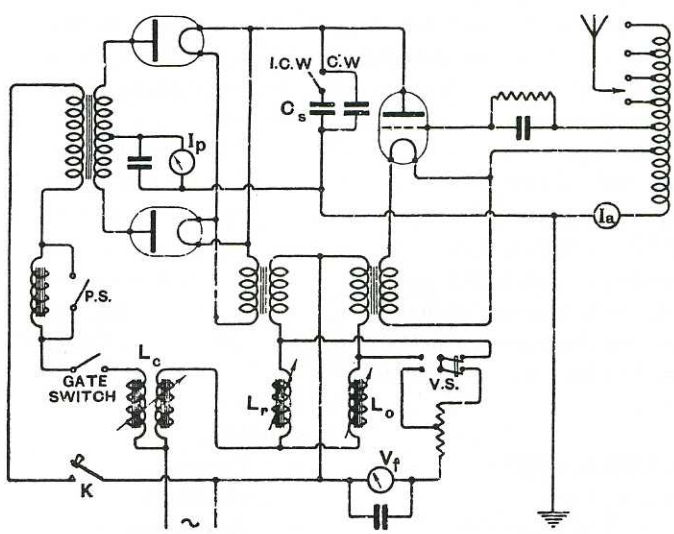
I got my amateur licence in 1947 on the strength of my PMG Certificate and became G3DZX. Until I retired in 1965 I was never very active, but since then I have found great friendship and enjoyment on 80 and 40 metres. ***RB***

The above article is based on letters written by Frank Bailey in 1990, during a brief correspondence in which we shared reminiscences about our seagoing days. It was with great sadness that I learned of his death last autumn, before he had a chance to see his words in print.

Geoff Arnold



Radio Communication Co. 1½kW CW/ICW Transmitter, Type T22. The unit measured 26 inches wide, 20½ inches deep and 43 inches high, with the wave-change switchgear projecting about 4 inches either side. Range on long-wave CW (1800–2600m) 1500 miles, on medium-wave ICW (600–800m) 750–1000 miles



Circuit digram of the RCC T22. The valves used were two MR4 rectifiers and one MT6B oscillator/PA triode, all mounted on spring clips.
Power was derived from the 110V or 220V DC ship's mains supply via a 200V 500c/s motor alternator. By switching the additional smoothing capacitor C_s out of circuit, 1000c/s ICW modulation was produced

The photographs and circuits in this article are reproduced from Handbook of Technical Instruction for Wireless Telegraphists, *(1946) by kind permission*

Famous Names, No. 1
Radiospares Ltd.

by F. C. Judd

Fig. 1 - The Founders of Radiospares Ltd. (1936)

Many present-day, well known and respected British manufacturers and suppliers of radio, electronic equipment and components, etc., were founded by one or two young men with little money, lots of enthusiasm, some having to start with a back room in the house, or garden shed as business premises. This is the story of one company that began in much the same way and over the years became known to radio and TV dealers and their service engineers, research and development engineers in the radio, radar, general electronics and computer industries, as well as to radio enthusiasts throughout the UK.

The original Radiospares Ltd. is now RS Components Ltd., who cater solely for the industry. It is one of the Electrocomponents PLC group of five companies in the UK, including 'Electromail' now well known for suppling the enormous range of RS components to home constructors of radio and electronic equipment. Electrocomponents PLC also has a 'market presence' in eleven overseas companies including France, Germany and Australia.

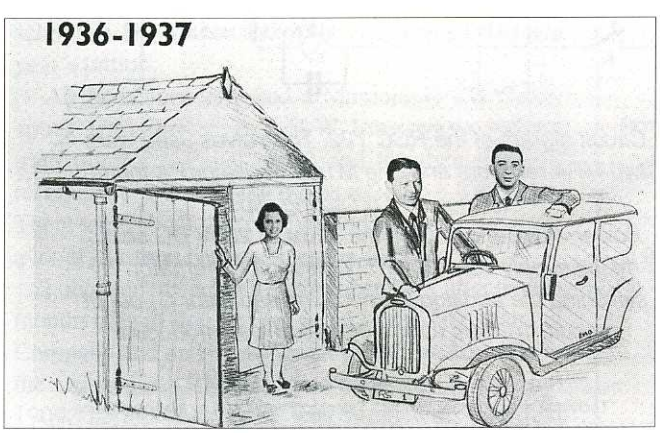


Fig. 2 - The 'garage'. First business premises of Radiospares Ltd.

Radiospares Ltd. – the Beginning

Even by the late twenties the sales of radio sets had become big business and over the years that followed the demand for radio set repair work, or servicing, to use the more familiar term, began to escalate. It gradually became a difficult and often long-winded process for dealers to obtain common replacement components like electrolytic capacitors, volume controls, dial lamps, etc., even from the set manufacturers. This dire need for radio components of various kinds was a challenge to two young men, J. H. (Herbert) Waring and P. M. (Paul) Sebestyen (**Fig. 1**). With only £100 company funds and a lock-up garage to serve as office and warehouse they took on the task of buying and supplying the much needed components to radio/service dealers. With two cars, one each for our determined salesmen, and Mrs Amelie Waring, wife of Herbert, installed in the lock-up garage to look after the stock, act as invoice clerk and deal with the packaging and posting of orders, etc., Radiospares Ltd. became fully established in 1936 (**Fig. 2**).

The Early Years

By early 1937 came the first expansion. Larger premises at 44 Birchington Road, London NW6 and which had originally been the Gas Company meter collection offices, known locally as the penny office. It was nice to be out of the garage, but the new premises were full of bugs ! However, as Mrs Waring put it, 'Bugs and coppers are lucky'. Her observation was to prove true. Business increased, appropriate new staff were engaged and most important, the first Radiospares catalogue (**Fig. 3**) was produced. It was a small catalogue with three pages. Parts of it, shown in **Fig. 4**, indicate the limited range of components available but as we shall see later this was to play an important part in the growth of Radiospares. On the back page was an announcement for the benefit of customers:

'A FEW PRINCIPLES OF OUR BUSINESS
No Job Lines, No Discounts.
One Price Only.
Strictly Trade Only Supplied.
Unconditional Guarantee - The Customer Is Always Right.
24 Hours Service With A Smile.
Quality: The Minimum standard is that of the RCMF.'

Employed as a young radio service engineer at the time, the writer well remembers that catalogue and of course the 'representatives' who called.

1939 – Peace in Our Time?

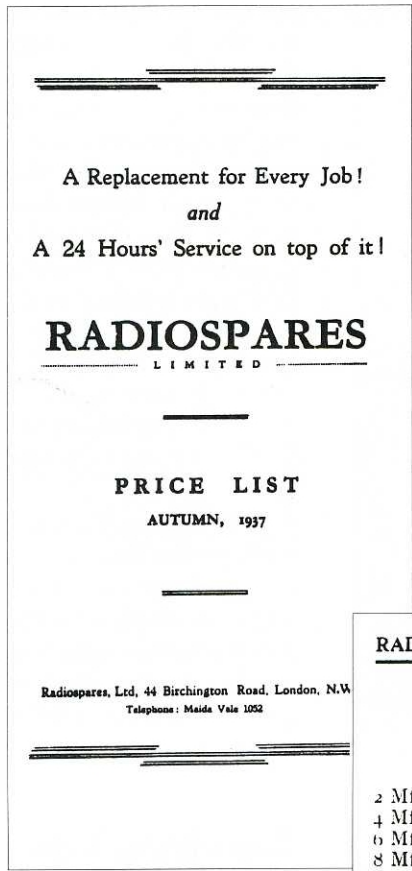
Wishful thinking no doubt but on the 3rd of September of that year World War II was declared. Mrs Waring rejoined the Company (she had left previously for a well earned rest) and her new job was to run their first 'takeover', the Franklin Electric Co. of Howland Street, London W1. At this time however, an announcement had been made by Parliament that it was important to keep the country's radio receivers going so that the public could obtain up to the minute wartime news. Few manufacturers were able to supply even common spare parts because of other commitments. Nevertheless, the demand for components by radio set service/dealers had to be met.

Although Herbert Waring and Paul Sebestyen were classified as having a reserved occupation, they had lost most of their team of representatives to the services. Despite this drawback, food and petrol rationing, and of course the air raids, they were able to hang out the Business As Usual sign during five years of World War II. Like the famous Windmill Theatre in London, Radiospares Ltd. never closed !

The Policy and the New Function

The foregoing is but a brief account of the very early days of Radiospares Ltd. After the War but with the company still very much in the hands of its founders, Herbert Waring and Paul Sebestyen, some changes were made. Although the basic policy to supply only bona fide dealers remained, a sales brochure issued after the war set down very clearly the future terms of trading.

'HERE ARE THE MAIN ADVANTAGES WE ARE ABLE TO OFFER YOU.
Reliable guaranteed components.
Promptest Delivery in the Trade.
Reasonable cost always.
Straight dealing throughout.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'The Radiospares organisation is the only one of its kind available to service-men *(i.e., Radio and TV repair men – Ed.)*. It simplifies the whole problem of obtaining components, cuts out delay in delivery and prevents the risk of getting inferior goods or having to pay inflated prices.'

The Flat Salesman!

By the end of the war in 1945, the RS catalogue, which had steadily increased in size with each passing year, had become known as the Flat Salesman.

In fact Radiospares Ltd. claimed they had two kinds of salesman, one being the men in their cars, although

RADIOSPARES Ltd. 'Phone: Maida Vale 1052

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"Radiospares" Dry Electrolytic Condensers.
500 Volts Peak Working, in waxed Cartons.

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4 Mfd.	1/3	8+4 Mfd. C.N.	2/0
6 Mfd.	1/4½	8+6 Mfd. C.N.	2/3
8 Mfd.	1/6	8+8 Mfd. 4 Leads	2/6

"Radiospares" Dry Electrolytic Condensers.
500 Volts Peak Working, in 1½-in. Neutral Cans.

4 Mfd.	2/0	8+4 Mfd. C.N.	3/0
8 Mfd.	2/3	8+8 Mfd. C.N.	3/6

"Radiospares" Wet Electrolytic Condensers.
500 Volts Peak Working, in 1½-in. Neg. Cans.
8 Mfd. 2/6

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4+4+4 Mfd.	C.N. 500 Volts (Ekco)	2/9
12+8 Mfd.	C.N. 500 Volts (Ekco)	3/6
16+8 Mfd.	C.N. 500 Volts (Various)	4/0
8+8+8 Mfd.	C.N. 500 Volts (Various)	4/3
8+24+2 Mfd.	C.N. 500/250 Volts (Ekco)	4/0
8 Mfd.	1-in. Neg. Can, 450 Volts (E.M.I.)	2/9

PILOT BULBS, Special Types.

2 volts, .06 amps, Tubular M.E.S.	doz.	2/6
4 volts, .3 amps, Tubular M.E.S. (E.M.I.)	doz.	4/6
6/8 volts, .3 amps, Tubular, M.E.S. or B.C. (Philco, etc.)	doz.	5/6
Neon Tuning Indicators (Ultra, etc.) 4-pin	each	2/6

AMERICAN VALVE HOLDERS.
4, 5, 6, or 7 pin ... 6d. Octal ... ... 9d.

LINE (RESISTANCE) CORDS, for Mains Voltage dropping.

2 Core (220 volts to 110 volts) with both ends	3/6
3 Core (no ends) per 100 ohms Resistance	1/0

PICK-UPS WITH VOLUME CONTROL (Bakelite) ... 7/0
PICK-UP HEADS (Bakelite) 3/4

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For A.C. Mains, 110-240 volts	32/6
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The first Radiospares Ltd. catalogue. Fig. 3 (top) - The front cover. Fig. 4 (right) - extracts showing part of the product range of the time

Fig. 5 - Continually expanding these were the Radiospares premises in Fitzroy St., London W1 in 1946

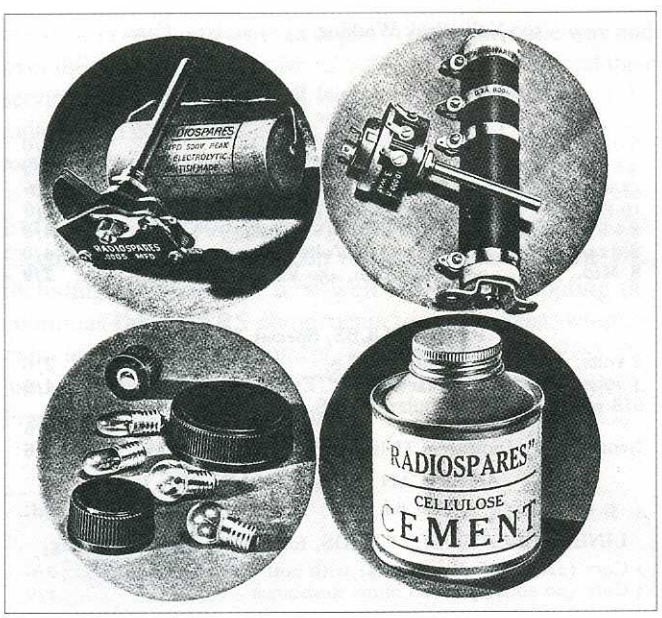

Fig. 6 - A selection of items available from the Radiospares catalogue (circa 1946)

Fig. 7 - The 'Flying Man' logo which appeared on catalogues and postal wrapping when trading began from Fitzroy St., and remained in use for 25 years

after the war there were not enough to cover the whole country, the other being the catalogue. 'Flat enough to slip through your letter box. The Radiospares Postal Bulletin tells you just what components we have in stock and in what quantities. It keeps you constantly in touch and continually up to date', etc.

So a 'mail order' service was developed which soon gained a reputation for speed and efficiency. A virtual overnight return of phoned or mailed orders. But this called for expansion and in 1946 Radiospares Ltd. became located in new and larger premises in Fitzroy Street London W1 (**Fig. 5**). From here there were four ways of ordering:

'1. Direct post to our Headquarters.
2. Through our representative when he calls.
3. By telephone if you are in a hurry.
4. From our Trade Counter at Fitzroy St.'

With continued expansion in terms of premises and staff, and a greater than ever range of components, the catalogue became large enough to warrant considerable study by customers. Aside from different kinds of capacitors, resistors, potentiometers, valve holders, transformers, control knobs, connectors, etc., there was the first tin of what became popularly known as RS goo. Otherwise listed as cellulose cement (**Fig. 6**) it paved the way for switch cleaning fluid and numerous other useful 'chemicals' in tins, bottles and tubes.

The Flying Man

It was at this time that the Radiospares Ltd. 'logo' – the flying man as it was called (**Fig. 7**), appeared on orders through the post.

However, by 1955 Radiospares Ltd. had outgrown the Fitzroy Street premises so it became a case of moving again: this time to Maple Street, London W1. Also that year, a company called Reading Windings Ltd. was acquired. By 1969 even larger premises were needed. The new address was 13–17 Epworth Street, London EC2, one that even today many service engineers will not have forgotten, or of course the Flat Salesman, still very much in evidence today, although at 1500 pages and one and a half inches thick, listing 25 000 products, it is no longer particularly 'flat'.

So we come to an end of an era that paved the way for the present day Electrocomponents PLC group who continue to serve the many as did the original Radiospares Ltd. founded in 1936 by a very few. Paul Sebestyen retired in 1970 and Herbert Waring in 1973 and although these pioneers are no longer with us, they are well remembered.

My sincere thanks are due to Mr Norman F. W. King OBE, the present Chairman of RS Components Ltd., and to his Secretary, Mrs Pauline Wood, for the kind assistance with information and photos.

Can You Help?

Norman F. W. King is currently assembling material for a museum of the history of the company. If any readers have memories, or material (including components), etc., dating from the pre-war period (1936 on) or immediately post-war of Radiospares Ltd., which they would be prepared to contribute, Mr King would be delighted to hear from them. His address is: Norman F. W. King OBE, Chairman RS Components Ltd., PO Box 99, Corby, Northants NN17 9RS. ***RB***

● Radio is mankind's greatest discovery! The most useful invention ever!

● The hand of 'Sparks' on many a Morse key has saved a million lives this century.

● Since the dawn of history sailors went over the horizon... into isolation/oblivion/eternity. No exaggeration. All sailors. Complete isolation.

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'My first reaction – what a beautiful piece of work! Spent half the night reading it – didn't turn my rig on or watch a lick of TV. Can't recall when I enjoyed a book more!' *Jim Maxwell W6CF*

'First book I've read for years just for the fun of it...particularly interesting to an ex-radio officer.' *Bob Schrader W6BNB*

'I have a complaint. I can't put the damned thing down! I read it last night on the sofa, then on in bed and gave up around midnight. I read it at breakfast, then took time out to be Net Controller on the Pacific Amateur Radio Guild, where I extolled the virtues of *QTC*.'
Ken Johnson W6NKE

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Kirsti Smith VK9NL, AMATEUR RADIO ACTION (Australia)

'I am sure that many of us who have sat beneath the ship's radio room clock...will identify with this story. A fascinating book which I can certainly recommend to any reader with seagoing connections.' *Geoff Arnold G3GSR, MORSUM MAGNIFICAT*

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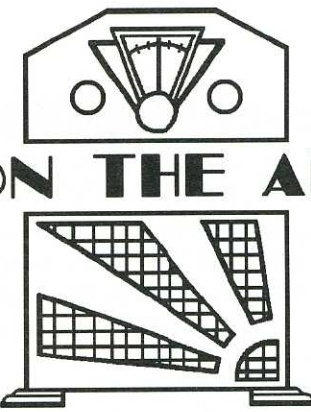

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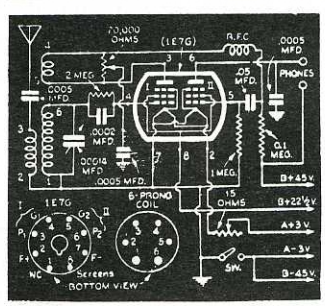

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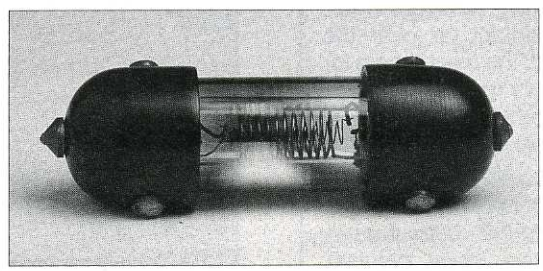
Whatever Happened To...?

In the 19 August 1925 issue of *Wireless Weekly*, there appeared an article entitled 'A New Short-wave System', written by J. H. Reyner, who has since become well known to many radio enthusiasts and professionals for his books on radio engineering.

That article gave details of a special investigation being carried out by Mr Reyner in the Laboratories of Radio Press, publishers of *WW*, on a new method of short-wave working proposed by Messrs. Autoveyers, Ltd., of 84 Victoria Street, London. The technical details of the system, which 'claimed to make communication between London and New York possible on a power of only half a kilowatt' had been obtained in a special interview with Mr A. E. Chapman, Technical Director to Messrs Autoveyers.



The valve relay used with the system discussed
From the Journeaux Historic Wireless Collection

The principles governing the effective use of short wave radio in long distance communications were being established at that time. The need to select a suitable wavelength according to the time of day was already known, although the possibility that effective communications might be maintained throughout the 24 hours by this means was not yet confirmed. Polarisation changes caused during the transit of the wave from point to point had previously been mentioned in the magazine, as had the improvement in results which might be obtained by tilting the receiving aerial in such cases.

Beam aerials were already in use for transmission, though it appears that at that time, radiation was being focused only in the horizontal plane. The new system proposed by Messrs Autoveyers was to include a second focusing arrangement 'by means of which the rays would be kept within the confines of a certain vertical beam as well as a horizontal beam,' so that 'a more or less solid ray would be emitted from the transmitting point.'

The article goes on to describe a number of new techniques which were to be adopted at the receiving end...

'...at the receiving point the receiver is to be in the form of a simple oscillator pivoted about its middle and capable of rotating in any direction. By this means it can be placed in the most suitable position at each time of the day to allow for the variations in the plane of polarisation of the electro-magnetic wave radiating from the transmitting point.

Magnetic Fields

It is claimed that this system makes use of the magnetic field in the wave rather than the electrostatic field. We presume that what is meant is that the system does not employ any earth connection, but that the radiating and receiving systems are more of the nature of Hertzian oscillators than of the ordinary aerial and earth transmitting arrangements.

It is, of course, well known that the electric and magnetic fields of a wireless wave are inseparable, being merely different manifestations of the same phenomena, but it is sometimes more convenient to regard the effects from a magnetic point of view.

A New Type of Valve

An important point in connection with this new system is the use of a special type of valve. One of the chief difficulties

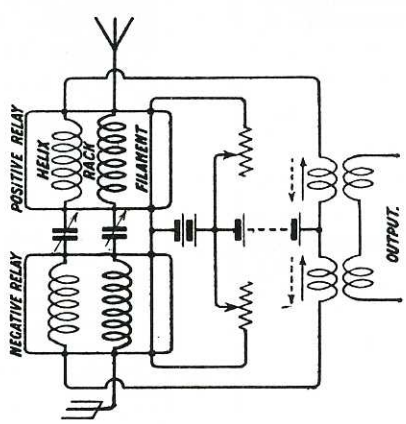


Fig. 1.—One form of receiving circuit it is proposed to use.

encountered in dealing with the very high frequencies necessary to produce ultra-short waves lies in the capacity effects experienced with the ordinary types of valve. In this system, therefore, a special form of valve relay is employed in which the tuning coils are incorporated in the electrodes themselves.

The device consists of a filament of wire surrounded by two spirals, which are termed the 'rack' and the 'helix', corresponding to the grid and anode in an ordinary valve. The ends of these spirals are brought out to separate connections on the ends of the valve, so enabling the high-frequency oscillating currents to be passed round the electrodes themselves. By this means it is claimed that an electro-magnetic control is obtained on the electrons emitted from the filament, and the effect of inter-electrode capacities is minimised.

The Receiving Circuit

A circuit incorporating these new valves is shown in Fig. 1. There are two types of valves, known as the positive and the negative types. In one of these the spirals are wound clockwise, while in the other they are wound anti-clockwise. It is claimed that the aerial currents, which flow around the 'racks' of the relays, exercise a magnetic control on the emission.

'Push-pull' Arrangement

Due to the reversing of the direction of the spirals in the negative relay, it is claimed that an increase of current in the positive relay is accompanied by a decrease in the negative relay, and vice-versa, so giving a 'push-pull' arrangement.

For scientific reasons we do not agree with this explanation.

We were informed that this relay is very much more sensitive than the ordinary valves, and in one form or another it is used in all the apparatus embodied in this new system.

Practical Tests

It is understood that this type of relay will very shortly be placed on the market for the use of amateurs, and although it is designed primarily for very short waves, it is claimed that by the use of suitable loading inductances it may be used very successfully on the ordinary broadcast band of frequencies.

In order to verify this statement and find out whether there was any appreciable improvement resulting from the use of this relay, some tests have been carried out at the Radio Press laboratories, with the following results:

The two valves were connected up in a manner similar to that shown in Fig. 1, except that loading inductances were inserted in the 'rack' and 'helix' circuits. The output circuit, of course, contains high-frequency currents, which will be inaudible unless rectified. Hence the output coil was tuned and applied to the grid of a valve arranged to give the usual cumulative grid rectification.

The resulting signal strength was disappointing, being little, if any, greater than that obtainable with a simple single valve set.

A certain reaction effect was produced by coupling the 'rack' and 'helix' circuits together. Oscillations could be produced, but in this case the circuit became 'floppy', which one would rather expect, seeing that the 'rack' is free. The case is identical with the building up obtained in a valve having a free grid.

With the idea of dispensing with any apparatus other than that proper to the relays themselves, the circuit shown in

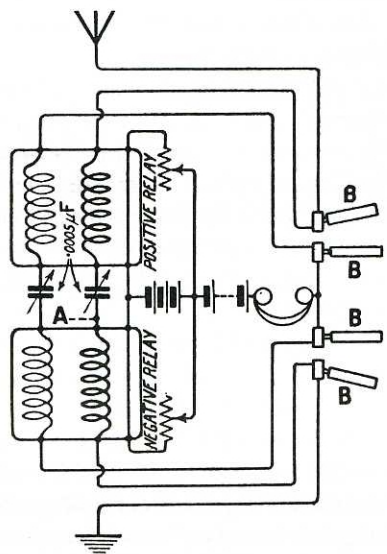


Fig. 2.—A second form of receiving circuit.

Fig. 2 was tried, and was found to give results almost as loud as the original arrangement.

Magnetic or Static Control

At this point, in order to gauge the effect of the 'rack' on the emission, one of the 'racks' was short-circuited. No difference in the signal strength could be observed, so the other 'rack' was short-circuited. The signals remained as loud as before!

In order to investigate this effect the characteristics of the valves were taken. With a filament voltage of 1.8, and a current of 0.25 amp, the emission (with an HT voltage of 60) was 1.45 milliamps. The passage of current through the 'rack', in either direction, had practically no effect.

Actually, a current of 0.5 amp through the 'rack' increased the emission by 0.015 milliamp, irrespective of the direction of such current. These tests appear to indicate conclusively that the magnetic control of the emission is negligible, and that any effects which are obtained are electrostatic, as with an ordinary valve.

Use at High Frequency

Since these relays, however, were designed for high frequencies, experiments are in progress to ascertain whether they exhibit any superiority over ordinary valves at such frequencies. A certain benefit may accrue from the fact that the electrodes themselves can be used as part of the tuning circuits, but this will remain to be seen.'

Was any further development done on the 'valve relay'? Was any other information on the Autoveyers receiver system published? Or did it quietly disappear into oblivion, having been seemingly debunked by J. H. Reyner. The device certainly existed, as proved by the photograph of the example from the Journeaux Historic Wireless Collection. ***RB***

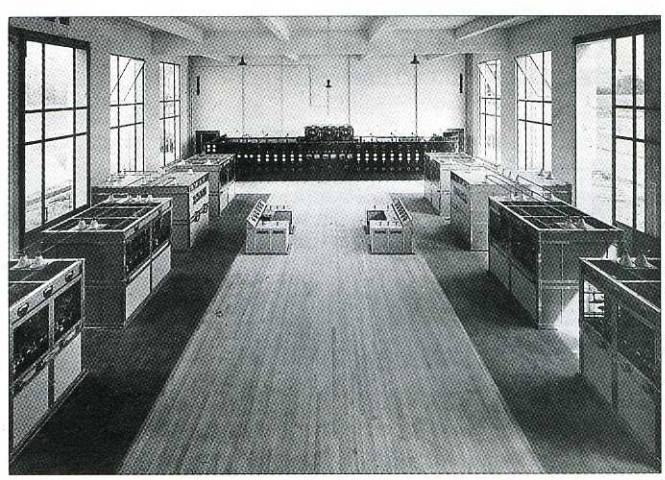
COMPETITION

Where is it? - No. 6

Another teaser for you. Can you say where and roughly when this photograph was taken? Send your answer, on a postcard or the back of a sealed-down envelope, to Radio Bygones, 8A Corfe View Road, Corfe Mullen, Wimborne, Dorset BH21 3LZ, England, to arrive not later than May 10.

First correct answer drawn out of the Editor's hat on that day wins for its sender a year's subscription to *Radio Bygones*. The answer, and the name of the winner, will appear in our next issue.

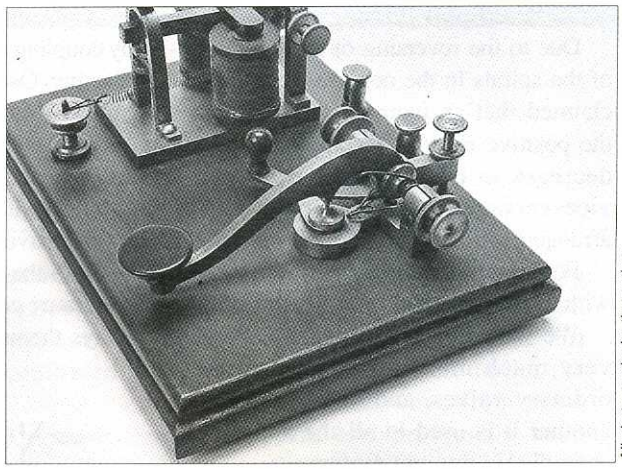
The closing date for receipt of your entries is Friday, 10 May 1991. The Editor's decision is final.



Photograph by kind permission of GEC – Marconi Ltd.

History of the Canadian Key

by Murray D. Willer VE3FRX



All photographs by the author

Fig. 1 - Early American camelback key

Up until the beginning of the 18th century, the fastest means of communication was virtually the horse on land, and the sailing vessel at sea. However, some simple signalling systems had been developed over the years. The Greeks, Phoenicians and Persians used fire beacons with a prearranged code, usually in time of war. In Africa, some of the native tribes used drums to pass messages from village to village, while in North America the Indians used smoke signals. The British navy used flags and pennants to signal between ships. In 1792 a Frenchman, Claude Chappe, developed his semaphore system, using manually operated semaphore arms mounted on high towers which he spaced 5 to 10 kilometres apart. This semaphore system, with modifications, was adopted by several other European nations. While these aural and visual 'telegraph' systems were useful, they all had severe limitations.

What was the communication picture in Canada? In 1845 there was one short steam-railway in Lower Canada (now Quebec) and one short horse-railway in Upper Canada (now Ontario). Steamboats plied the Great Lakes and canoes travelled the smaller rivers during about eight months of the year. These, plus footpaths and a few highways, the condition of which left much to be desired, afforded the only means of travel and communication. If an important event happened in Europe, it could be several months before a farmer in Upper Canada heard about it.

In 1844 Samuel Morse demonstrated his electromagnetic telegraph system to the US Government on a line between Washington and Baltimore. The demonstration was a complete success, and within a relatively few years, telegraph lines connected most of the major centres in the USA.

When one of the telegraph lines from New York reached Buffalo, a number of Toronto entrepreneurs decided to run a telegraph line from Toronto to hook up with the line at Buffalo. 'The Toronto, Hamilton, Niagara Electro-Magnetic Telegraph Company' was incorporated in October 1846. On Saturday, 19 December 1846, the line had been completed to Hamilton and at twelve o'clock noon, civic dignitaries and representative citizens in Toronto gathered together to hear and see telegraphers carry on communication with operators in Hamilton. By June 1847, the line had been extended via Queenstown and Lewiston to Buffalo. Thus news from Europe reaching New York could be telegraphed to Toronto via Buffalo. Communications in Canada had taken a giant step forward.

The year 1847 saw the Montreal Telegraph Company organised and before the year end, telegraph service between Montreal and Toronto had been established. The telegraph and the railway would soon help cement the colony fragments into a nation.

Most of the telegraph equipment for the new companies was obtained from the US. Morse type electromagnetic recording registers were used for printing the Morse code on a strip of paper which was then read by the operators. Later the registers would be replaced by electromagnetic sounders, with the operators reading the Morse code by sound rather sight.

The Hand Key

The hand keys used in these early telegraph operations were either of the camelback type (**Fig. 1**), so called because of their curved lever, or the straight lever type as shown in **Fig. 2**. These were supplied by instrument builders in the US. In 1881 James Bunnell, who was a telegraph operator during the US civil war, patented his steel lever key, and this design was soon adopted by most of the Canadian telegraph companies. That the Bunnell design was a good one was evident by the number of companies that copied it after the patents ran out, and a Canadian

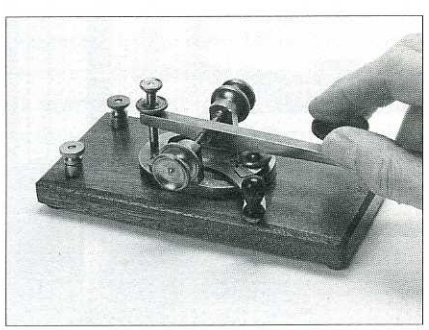


Fig. 2 - Early American straight lever key

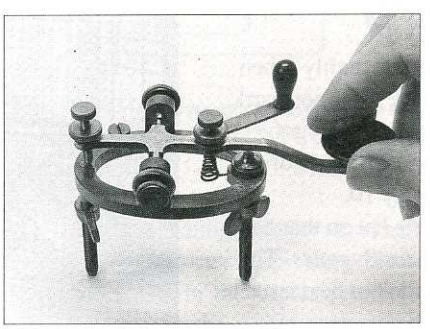


Fig. 3 - Early Canadian telegraph key by Ahearn & Soper, Ottawa

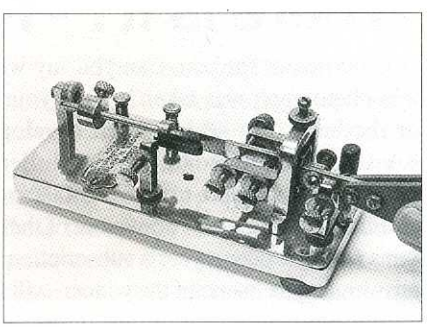


Fig. 4 - Xograph key by Rolph Brown, Toronto

key made by Ahearn & Soper of Ottawa and based on the Bunnell design is shown in **Fig. 3**. The long legs allowed the key to be permanently fastened to the operating desk. Connections were made underneath. Similar keys without the long legs were called 'legless keys', and became the standard telegraph key for Canadian telegraph operations.

The Semi-automatic Key (The Bug)

In 1904 an American, Horace Martin, obtained a patent for his 'telegraphic transmitter', and in his patent application just about sewed up the design of the semi-automatic telegraph key which he called the 'Vibroplex'. Martin and the Vibroplex company built a number of different semi-automatic keys, and collecting one of each of the Martin and Vibroplex keys would be a fair-sized project. During the twenties however, the Vibroplex patents started to run out, and a number of other companies jumped in and began to manufacture semi-automatic keys or 'bugs' as they were called.

In the 1920s, Rolph Brown of Toronto, who was with the Canadian Pacific Telegraph Company, brought out a bug which he called 'The Xograph' (**Fig. 4**). This was a neat small bug with a black or nickel plated steel base, and small enough to put in your pocket. It is possible that Vibroplex got one or two of their ideas from Rolph. Rolph died at a young age and the serial numbers indicate that less than 500 Xograph keys were built.

A Canadian, Fred Wilcox, an operator with the Canadian National Telegraph Company in Toronto, was an excellent machinist. He had a machine shop at home and built a number of bugs in the 1920s and 30s for his telegraph friends (**Fig. 5**). Fred did not use standard tooling, and as a result his bugs show various detail differences, but they all had heavy nickel plated steel or brass bases. It seems Fred didn't want his bugs moving around on the operators' desks. Serial number on these bugs run up to about 1500.

Another Canadian, Paul Dow of Winnipeg, also manufactured bugs. Paul and Horace Martin were good friends and it was Paul Dow's demonstration of the Vibroplex bug to the Western Union Telegraph Company that helped convince them to allow their operators to use bugs. Paul built a number of bugs varying in design but still similar to the Vibroplex. However, he believed that a more natural operating position was for the hand to be inclined to the right, and in one of his keys (**Fig. 6**), he inclined the pendulum and contacts at 30 degrees to the vertical. This was dubbed 'The Bent Bug'.

Later, Paul carried the idea further when he brought out his rotatable bug (**Fig. 7**), in which the whole pendulum and contact assembly could be rotated to the most convenient operating position and then locked by tightening a locking screw at the top. The Dow Company was later taken over by an American company, and some of Dow's bugs carry the identification 'Warren Minnesota' instead of 'Winnipeg Manitoba'.

Wireless Keys

When wireless came along at the beginning of the 20th century, all of the transmitters were spark. Because of the high current, the telegraph keys with their small contacts were not suitable, and heavier keys with larger contacts were developed. While the name Marconi is synonymous with the development of wireless, Marconi did not invent wireless. All of the ingredients to make wireless work were there when Marconi came along, but he was the first one to put them together successfully, and the first to establish a company to put wireless equipment on ships.

Marconi's early efforts to develop transatlantic wireless were of interest to the Canadian government which provided financial assistance to establish a station at Glace Bay, Nova Scotia, from which the first regular transatlantic wireless messages were sent. The Marconi Wireless Telegraph Company of Canada was formed in 1903 in Montreal, and by 1904 the Canadian Company was busy fulfilling a Canadian government contract for the supply and installation of eight wireless coastal stations for shipping and commercial wireless message traffic.

The Canadian company made keys as well as transmitters and receivers, and an early key made by them before World War I is shown **Fig. 8**. The nameplate is marked 'THE MARCONI WIRELESS TELEGRAPH COMPANY OF CANADA LIMITED'. Another early Marconi key believed to have been made by the Canadian company is illustrated

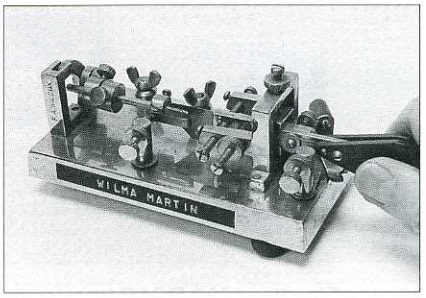


Fig. 5 - Fred Wilcox key, Toronto

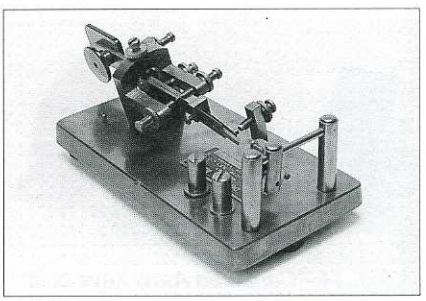


Fig. 6 - Bent bug by Paul Dow, Winnipeg

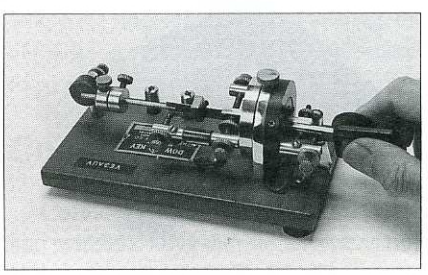


Fig. 7 - Rotatable bug by Paul Dow, Winnipeg

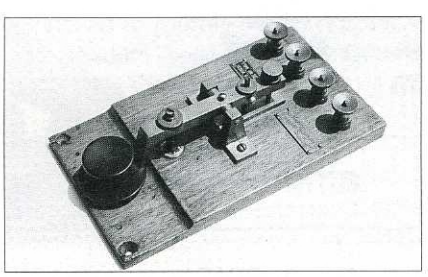


Fig. 8 - Key by Marconi Wireless Telegraph Company of Canada

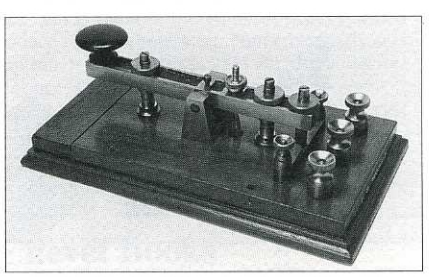


Fig. 9 - Marconi Wireless key

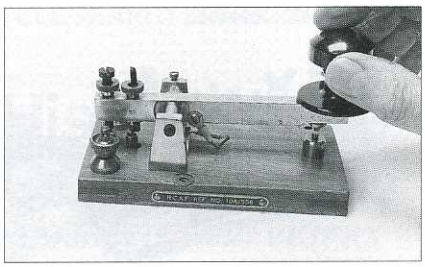


Fig. 10 - 1930 RCAF key

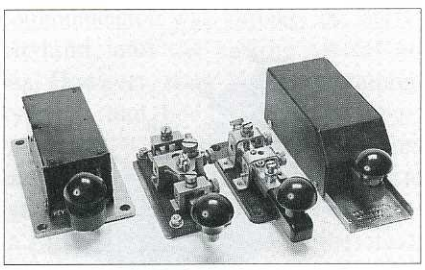


Fig. 11 - Canadian Army keys built by Northern Electric and Westclox

Fig 12 - Practice key by Wilson Company of Toronto

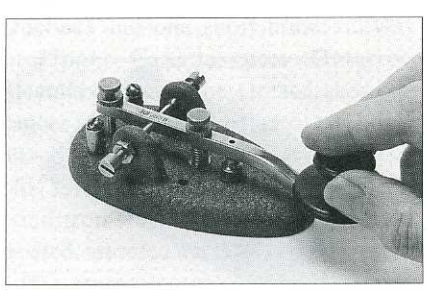


Fig. 13 - RCAF hand key by Wilson Company of Toronto

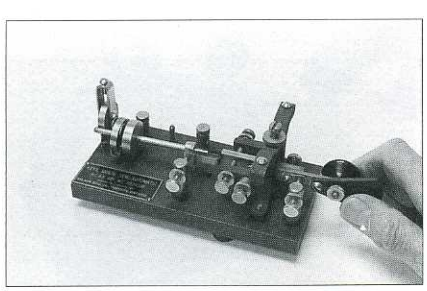


Fig. 14 - RCAF semi-automatic key by Wilson Company of Toronto

in **Fig. 9**. There were a number of different ways of keying the transmitter and disconnecting the receiver during transmissions, and in the key shown in Fig. 9, there are extra contacts at the rear of the lever to operate relays to do this.

The Marconi keys were quite large and could truthfully be called brass-pounder keys. American and Canadian operators usually mounted their keys at the rear of the desk, operating with their arms and elbows on the desks. But the British marine wireless operator preferred mounting his key at the front of the desk, and pounding away with his wrist and arm in mid-air, which he felt provided greater operating freedom, and perhaps this is another reason why Marconi keys were larger and heavier.

A well made key used by the Royal Canadian Air Force during the early 1930s is shown in **Fig. 10**. The key carries a nameplate marked 'RCAF REF. NO. 10A/556'. The design, with its long heavy straight lever and strong tension spring mounted at the rear of the fulcrum is typically British.

World War II

When World War II came along, there was a tremendous increase in communications requirements by the army, navy and airforce, and each service developed keys for its particular needs. **Fig. 11** illustrates several keys used by the British and Canadian armies and built by a number of different contractors. The two on the left were built by Northern Electric (now Northern Telecom). Brackets were made from nickel plated brass extrusions. The two on the right were built by the Westclox company of Peterborough, Ontario, and the brackets on these were made from pressed steel fittings. These keys were also made with steel enclosures as shown and fitted with webbing straps for fastening to an operator's thigh for use in vehicles or tanks.

During WWII, many small companies moved into contract work for the armed services. The Wilson company of Toronto, which made toys before the war, built a number of keys for the RCAF. **Fig. 12** shows a practice set incorporating a key, buzzer and battery holder. The nameplate reads 'BUZZER, PRACTICE, AIR CADET TYPE, RCAF REF. NO. 10A/4236'. The same company made an excellent hand key shown in **Fig. 13**. It was of tear-drop design with a cast steel base in air force blue. This key had a good operating feel.

The Wilson company also made a semi-automatic key for the air force, illustrated in **Fig. 14**. The RCAF, realising the need to quickly train large numbers of wireless operators, designed a bug that could be operated slowly, by incorporating a soft spring in the pendulum and adding two large pendulum weights, and the Wilson bug was one of the few bugs that could be operated nicely at slow speeds. The Wilson bug has a high tee-bar and high damper post which allows it to be turned on its side and with the pendulum locked, operated as a regular hand key. In addition it could also be mounted upside down, thus converting it into a left hand key. The bug carries the designation 'KEY, MORSE, SEMI-AUTOMATIC, RCAF REF. NO. 10F/7390'. These were readily available as surplus in Canada at the end of the war, but are now becoming quite scarce.

The key shown in **Fig. 15** was used in Canadian and British aircraft and was built in quantity in Canada. It was called the 'bathtub key' because of its shape. All of the hardware was mounted in the upper portion of the key, which swung open for contact and spacing adjustment. If the aircraft was going to ditch in the ocean, the operator snapped the closure spring over the knob's protective disk, which held the key down to send out a carrier signal that would assist in locating the downed aircraft.

The flame-proof key shown in **Fig. 16** has enclosed contacts contained within a heavy aluminium case. It was manufactured for the British Admiralty by the Spartan Company of London, Ontario. The nameplate reads 'ADMIRALTY PATTERN 2342 KEY, SIGNALLING A/SI'. It is believed to have been built for use in submarine detection equipment, although confirmation of its exact use is lacking.

Today

Most of the companies that built keys during the last 140 years or so have now passed into history. There are, however, several companies in the USA, Europe, Russia and Japan that still make keys, mostly for radio amateurs. So far as we know, there are no Canadian companies producing Morse keys today on a production basis. But radio amateurs, being what they are, often build their own

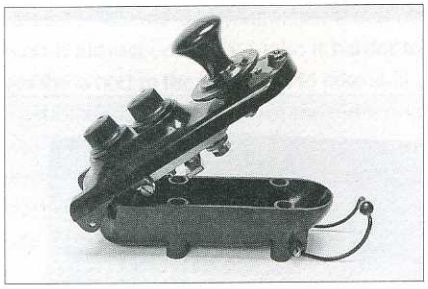


Fig. 15 - WWII 'bathtub key' used in Canadian aircraft

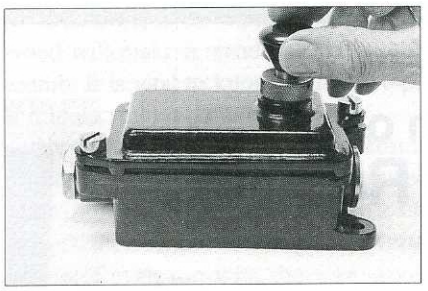


Fig. 16 - WWII key for British Admiralty by Spartan Company, London, Ontario

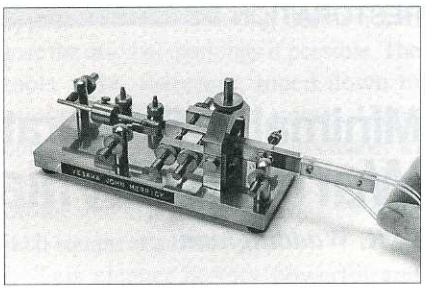


Fig. 17 - Home-brew bug by John Merrick VE3AWA

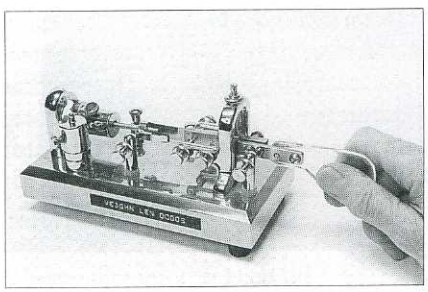


Fig. 18 - Home-brew bug by Len Dodds VE3GHN

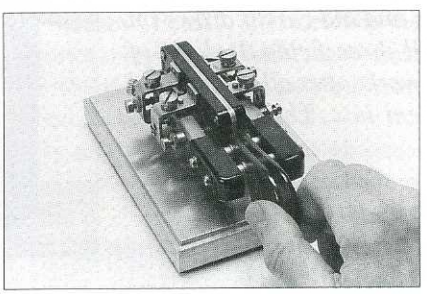


Fig. 19 - Home-brew paddle, maker unknown

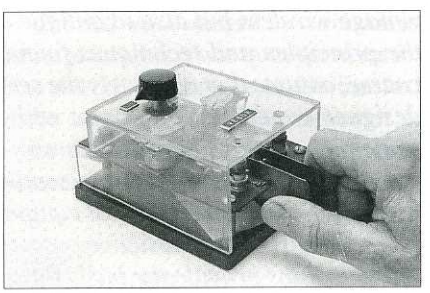


Fig. 20 - Home-brew paddle and keyer by Ray Hunter VE3UR

keys, and some interesting examples of Canadian home-brew keys show up from time to time.

The beautifully built brass bug shown in **Fig. 17** was built by John Merrick VE3AWA. The design is basically Vibroplex, but the workmanship is excellent. **Fig. 18** shows another bug, this one by Len Dodds VE3GHN. It has a very large, heavy stainless steel base and a post for holding extra pendulum weights. **Fig. 19** illustrates a key for fully automatic operation. It was built from two Westclox World War II hand keys mounted back to back on a common heavy base. It is well built and a nice operating automatic key. Picked up at a flea market, its maker is unknown.

The home-brew paddle built by Ray Hunter VE3UR, shown in **Fig. 20**, uses a capacitance technique. The finger pieces are made from solid copper stock and are connected to two separate tuned circuits. Touching the finger pieces changes the capacitance of the circuits which operate internal relays. In long CW contests where the fingers often take a beating, the capacitance paddle provides a softer, more restful mode of operation.

This article originally appeared in QST Canada, *official journal of the Canadian Radio Relay League*

Collecting Keys

Collecting and restoring telegraph and wireless keys can be an interesting and challenging hobby.

The author, whose collection now numbers over 250 keys from many different countries, welcomes correspondence on the subject, addressed to Murray Willer VE3FRX, 557 Spadina Road, Toronto, Ontario M5P 2W9, Canada. ***RB***

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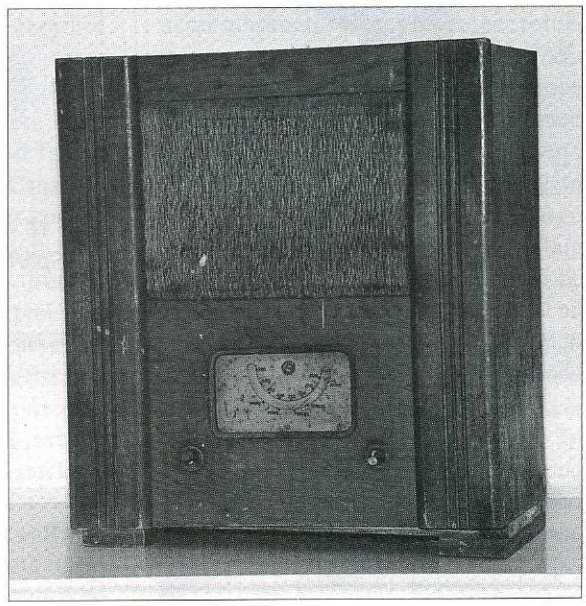
Minimalist Restoration of a Wartime Civilian Receiver

by R. Waddingham

This article is not intended to open up the debate about what is or is not good practice in restoration, rather it is one person's view of one particular way of doing things. Having an interest not only in vintage wireless but also in antique clocks and old cars it draws on the principles and techniques found in all three fields. It does, of course, assume that ultimately the set must work; after all the original designer would not be happy with a silent box. The three basic principles employed are as follows:

1. *Safety must over-rule sentiment.*
2. *Serviceable original equipment is preferable to new.*
3. *Dirt is not attractive.*

These axioms provide the basis for a minimalist approach.



In the beginning – not a pretty sight!

The Beginning

'What is that heap in the corner?' would have been a reasonable question at the start of this tale. Out in the shed suffering the ravages of damp weather and a leaking roof was the mortal remains of a Wartime Civilian Receiver. The back, knobs and top of the cabinet had long since been lost, what was left was not a pretty sight. The pine plywood sides had not only parted company with the bottom but they had delaminated into curly sheets of veneer held together in patches here and there. The loudspeaker frame was rusted and a thick caking of dirt obscured the dial.

The Restoration

The first move was to inspect it for signs of woodworm, then bring the whole lot back into the house and begin the drying out process. Easy-does-it is the way in these circumstances, as fast drying will cause even more damage, particularly to the woodwork and loudspeaker. A week in a cool dry bedroom was prescribed, followed by another in the warmth of the living room. All this time puts a great strain on the will but relieves the strain in the wood.

After removing the chassis, the valves were taken out for safe storage, then it was put in the airing cupboard to really dry out the components, particularly those wax capacitors. The loudspeaker was taken out along with the filthy dust bag it was in. The remnants of the case were thoroughly cleaned with the domestic vacuum cleaner and a dry soft brush. This was followed by a quick wipe with a very slightly damp cloth, wiping in the direction of the grain. Not much pressure here and no letting the wood get wet.

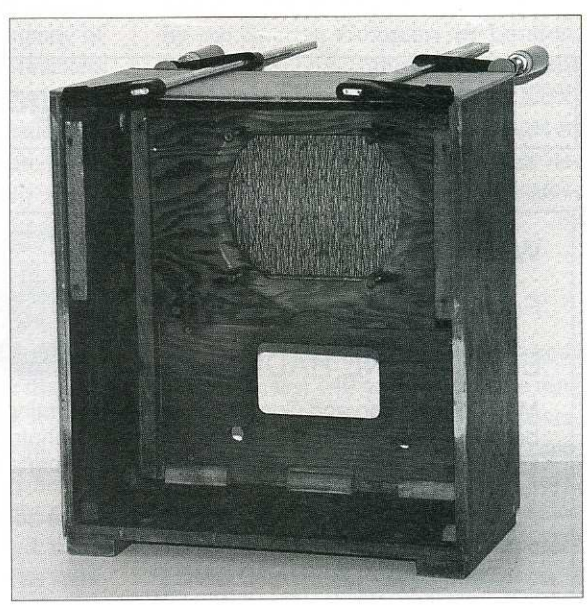
The delaminated plywood was stuck together using a modern wood glue. It was quite difficult to get the glue between the laminates in places but using various bits of card to spread the glue about it was finally ready for clamping. Good solid pieces of smooth, flat, planed wood were used to clamp the veneers back together into a flat sheet. With the clamps applied tightly and evenly the glue was squeezed out along the edges. This was the time to clean off all the surplus glue with tissues then a damp cloth. If you don't you regret it!

By now the cabinet remains consisted of plywood again, so the sides could be glued and clamped back to the case bottom. After this a new case top was made and glued, clamped and pinned in place.

Some wood-stopping was used to backfill the veneer pin holes, then a thorough sanding of the new top had it ready for staining. Now came the tricky part.

Despite appearances the original wood stood a good chance of being restored to an attractive state without repolishing. Remember the minimalist axioms and never rush into repolishing, you can always do it later if all other attempts fail. The problem was that the existing wood had some scratches, a thick coating of dirt and oxidised polish, and the new wood would need to be colour matched. The sequence of events here is the one that seems to work the most reliably, although alternatives can produce equally good results.

The scratches had broken through the stained layers of the wood in places. The dirt and old polish made the true colour



The new top clamped in place

of the wood hard to judge, yet cleaning would almost certainly make it harder to get the wood in the scratches to take stain. First of all then the whole of the old wood was wiped over with a dark stain, starting with the scratches. In general a stain slightly darker than the expected finished colour is best for this type of work, as the scratches blend in better if they are dark.

After the stain had been given a few hours to dry the old wood was cleaned to within about half an inch of the edge of the new wood. The cleaning method employed was to use balls of cotton wool, about the size of a Brussels sprout, dipped in 'MIN' wood polish. With reasonably gentle pressure, small areas were cleaned using a circular movement. As soon as the cotton wool was dirty the ball was turned to use a clean side or discarded for a new new one. It was imperative to keep the polish off the new wood or else it would not take stain properly, hence the half-inch margin.

With the rest of the case cleaned it was then possible to see the correct colour to stain the new top to. For this sort of exercise it is essential to have a good selection of wood stains to use, because one thing is for sure, it will not be one of the standard colours you want. By using a test piece of the same wood, sanded the same amount, the colour of the top was slowly matched in to the sides by using a number of different stains. In this case it needed Medium Oak, Burmese Teak and American Walnut in several applications to gradually bring the colour into line.

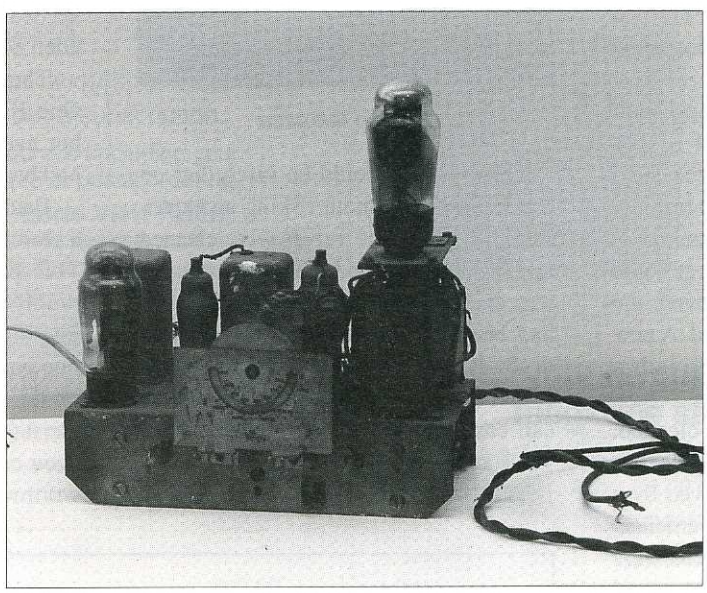
Again as a general rule it is best to err on the dark side if you must err, but remember that the application of French polish tends to alter the colour slightly. It is important to keep the test piece up to date with the main workpiece so that the effect of polishing can be tried out before committing the workpiece to polish.

Once the colour was right, the French polish was applied. Between coats the surface was lightly rubbed with fine wire wool to remove any roughness.

The secret of good French polishing is not to rush the process. It is not a high build finish and it takes several coats to build up thickness. Equally important is to get the build right. Too much polish on a new piece of wood amongst old wood will make it stand out like a sore thumb. It is vital to know when to stop. If it looks right it probably is right.

Next with the new wood colour matched and polished the whole lot was left to thoroughly dry. Then, horror of horrors, the new polish was given a very light and even rub with the wire wool again. The purpose of this was to take off the newly polished look and tone down the gloss. This was done along the grain with a good deal of attention to evenness and lightness. Finally, after cleaning the half-inch margin with 'MIN', the whole case was dusted and wax polished with a good quality furniture polish.

By now the chassis was completely dried out, so out came the vacuum cleaner and the soft brush for the first stage in the clean up. With considerable care around the fragile coils, the brush was used to coax the dirt and dust into the hose. Both sides of the chassis got the same treatment. At last the 'U' marking became visible; it was U11, indicating that the set was made by A. J. Balcombe (see Table on next page for a full list of codes). This manufacturer's code, which was there for guarantee claims, was printed in black on the back of the chassis, but by now it was quite faint.



The chassis

Several solvents were tried for improving the condition of the chassis but nothing made much impact. As there was a distinct risk of losing the markings on the chassis it was decided that no further improvements could be made and so it was left.

The dial was tackled next and this was approached with a strong desire not to lose the original markings if possible. The tools were, therefore, toned down to minimise their potential power. Using cotton buds and ceramic hob cleaner in very small quantity, the dirt was eased off the dial in areas about a quarter of an inch square at a time.

This cleaner is very powerful and contains an abrasive, so it must be used with extreme caution. It can, however, bring quite startling results if used carefully.

The dial was damaged by corrosion in a few places, but it was quite serviceable. The overall appearance in the finished radio is quite acceptable, although at some point in the future it will receive some touch up work.

The original dial cord spring was still in place, trapped by the dial, although all traces of the drive cord had long since vanished. The drive spindle was cleaned with wire wool then oiled. All seemed well so a new cord was installed. Fortunately in this set the cord routing is simple, in many others one is well advised to take note, before removing anything, of whatever clues the remnants of the existing cord may offer.

The loudspeaker was tackled next. It was a rather sorry sight with the plating having suffered corrosion damage in a number of areas. The output transformer was checked for continuity. It had an open circuit primary. A mixture of disappointment and pleasure at finding the fault was followed by the realisation that the heap of transformers in the component graveyard was useless, as this transformer was marked 6000 to 2.5 ohms. Rescued by a colleague's kind donation of an almost identical transformer, the project continued.

The graunching sounds emanating from the cone when it was moved indicated dirt in the voice coil, After cleaning and painting the frame, using a matching zinc based paint, the screw in the centre of the voice coil spider was removed. By carefully easing the cone forward, brushing the dirt around to one side and vacuuming the dirt away, with a thin tube taped to the end of the vacuum

cleaner hose, the voice coil area was cleared of all debris. A thorough inspection of the paper cone showed it to be intact so all that was left was to centre the voice coil.

Many methods exist for this fiddly task but the one employed was trial and error. With a careful eye the gap can readily be judged to be even. Gentle movements of the cone will soon indicate any gross alignment errors. It sounds rather crude but it is surprisingly effective with practice.

Next the manufacturer's label (Plessey) was stuck back in place using a clear adhesive. The black dust bag was washed in a mild detergent, dried, ironed and tidied up. The fabric was quite weak but it does not need much strength to keep dust off so it was put back into service. The speaker was reassembled into the case with the bag looking quite presentable.

At last down to the electronics. Well not quite. The twisted pair of rubber insulated, cotton covered wires used for the mains connection looked original but decidedly unsafe. Also it looked as if the mains switch had failed at some time, because it had been removed, the wires soldered together and taped. A new mains switch was fitted along with a new cotton covered mains lead.

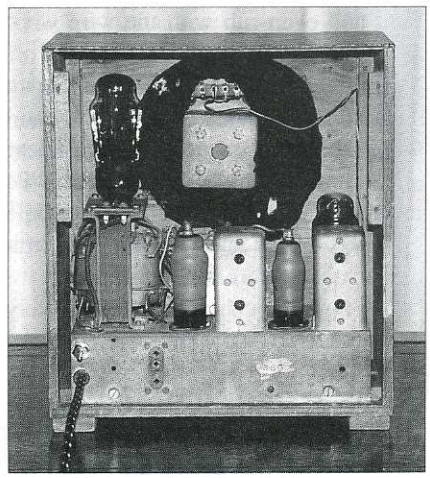
All the valve holders were cleaned. The under-chassis components were given a visual inspection followed by a few judicious resistance measurements.

The main smoothing capacitors were checked for shorts, they were not as high a resistance as might be preferred but would probably form up with care. The R3 rectifier valve was wiped clean, inspected, checked for heater continuity and anode – cathode shorts. All seemed well so it was popped in its socket for the real test. A voltmeter was connected across from the rectifier cathode to chassis.

The Resuscitation

Time for the turn on. A final check that the input tap on the mains transformer was set to the correct voltage. The mains was applied, lights appeared in the top of the valves. The voltmeter was watched for signs of HT from behind the sandbags!

After a short delay the HT started to climb slowly up to about 150V. A further 10 seconds then the mains was turned off and the HT dropped like a stone. Those capacitors seemed pretty leaky. A short rest then back with the mains on. This time the HT staggered up to 170V before the count of ten was reached and the mains turned off for the relaxation period. A few more of these sessions and a good 200V plus was being achieved.



Back in the case

Once the HT could be safely left on for 5 minutes, without risking an explosion, the rest of the valves were cleaned and installed. The 6AG6G output valve was checked for anode shorts in case it had been the cause of the transformer death. It checked out fine, as did its grid coupling capacitor (a leaky capacitor here can cause large currents in the output valve anode circuit).

A shot of switch cleaner in the volume control and lubricant on the main tuning capacitor bearings then on with the mains. All the valves lit up. The loudspeaker produced a faint hiss. In went the aerial – not much of a crackle, all was probably not well. With careful tuning a faint sound of Glen Miller came out of the speaker. Funny that, old radios often seem to play vintage music. The set seemed as deaf as a post.

All the main DC voltages were believable, so the valves were probably working. Touching the grid of the output valve with a screwdriver produced a healthy crackle. Same with the IF amplifier but the mixer produced nothing. Measurements around the mixer soon showed up an open-circuit coil. This proved to be a corroded wire on the coil itself. The connection was remade, the set was turned back on an there was Glen Miller, loud and clear.

The alignment was checked next. One IF transformer was a fraction off but everything else was like the day it had been built. Quite remarkable.

Back in the case with the chassis, then a search around for some suitable knobs. This proved to be the most difficult problem, as usual, and along with the missing back panel remains one of the two points which still need resolving. As for the results, judge for yourself whether the start and finish photographs *(see the front cover for the 'after' view)* show a worthwhile restoration. ***RB***

Wartime Civilian Receiver – Manufacturers' Identification Codes

Code	Manufacturer
U1	Bush Radio
U2	E. K. Cole Ltd.
U3	A. C. Cossor Ltd.
U4	The Gramophone Co. Ltd.
U4A	Marconiphone Co. Ltd.
U5	Ferguson Radio Corp. Ltd.
U6	General Electric Co. Ltd.
U7	Murphy Radio Ltd.
U8	Philips Lamps Ltd.
U9	Pye Ltd.
U10	Ultra Electric Ltd.
U11	A. J. Balcombe Ltd.
U12	Burndept Ltd.
U12A	Vidor Ltd.
U13	Central Equipment Ltd.
U14	Ferranti Ltd.
U15	Felgate Radio Ltd.
U16	Hale Electrical Co. Ltd.
U17	Halcyon Radio Ltd.
U18	Invicta Radio Ltd.
U19	Lissen Ltd. (Ever Ready)
U20	McMichael Radio Ltd.
U21	Philco Radio & Television Corp. Ltd.
U22	Pilot Radio Ltd.
U23	Plessey Co. Ltd.
U24	Regentone Products Ltd.
U25	R. M. Electric Ltd.
U26	Decca Record Co. Ltd.
U27	Dulci Company
U28	R. N. Fitton Ltd.
U29	Portadyne Radio Ltd.
U30	Pamphonic Radio Ltd.
U31	Mains Radio Gramophones Ltd.
U32	Kolster-Brandes Ltd.
U33	Roberts Radio Co. Ltd.
U34	Radio Gramophone Development Co. Ltd.
U35	R. S. C. Radio Ltd.
U36	Beethoven Electric Equipment Co. Ltd.
U37	J. G. Graves Ltd.
U38	Aren Radio & Television Ltd.
U39	N. H. Radio Products Ltd.
U40	Ace Radio Ltd.
U41*	Solectric Ltd.
U42*	Whiteley Electrical Radio Co. Ltd.

*Battery model only

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Feedback...

The page where you can air your views

Letters should be original and not copied to or from other magazines

Automated Test Equipment

The view of the chassis of the 38 Set Mark II in the June/July 1990 issue of *Radio Bygones* brings to mind the ingenious method by which the factory production of these sets was tested in Murphy Radio. I am not sure about which Mark, but probably II.

Each finished WS38 had all its valves removed and substituted by a 5-plug harness, obviously thus making about 40 pin connections. By use of a Strowger-type switch the impedances between as many pin-pairs of the set as was necessary were each compared in turn with the impedance of the corresponding pin-pair on a specially checked standard WS38.

For each set the sequence of this comparator process ran automatically. At any mismatch it stopped and indicated which test path had an incorrect impedance. This information made it easy to find and correct the actual fault.

James M. Little
Welwyn Garden City

Wire Recorders

Reading Bob Ridley's article in *Radio Bygones* No. 8, some old memories came back to me. When I first saw the picture of the Wirek 'A' machine I thought it was an American 'Webster Chicago' machine, because the front panels were very similar to each other in design. Could this Webster Chicago be 'in family' with the Armour Research Foundation?

The Webster Chicago was known in Norway as a dictating machine and was also put to more professional uses. I also remember in my younger days I had a Minifon P55 machine I used to play around with in my pocket. But the name of this machine in Norway was a Grundig, and they were big in dictating machines later on. They were sold in Norway by a big company called Gustav Ring A/S, which now is no longer in action.

Thank you for an interesting article.

Tor van der Lende
Oslo, Norway

Kit Set

With reference to the 'Kit Set' illustrated on page 2 of *RB* No. 9, this is very probably correct, although the set could have been constructed from an article in one of the numerous magazines around at the start of wireless. Quite by chance, I was lucky enough to obtain recently a complete set of Harmsworth's *Wireless Encyclopedia*, c.1922/23 and in there are illustrated many sets similar to Dave Hooper's find. The cabinet could have been made by the Economic Electric Co. Ltd., or indeed it is possible that the receiver complete could have been manufactured by them, as they made many models and components around that era.

Amongst my collection I have two radiograms which bear no manufacturers' names and I suspect that they were home-brewed. It was quite common in the '20s and '30s to make cabinets, although it is possible I suppose that the makers' labels might have been removed at some time in the remote past.

In closing, may I congratulate you on another fine edition of the magazine.

M. C. Pavely
Beckenham

Why *Q*?

Reading Charles Langton's article 'Why *Q*?' in *RB* No. 9 reminded me that I had asked the same question back in the early 1960s while still at college.

If I remember correctly the tutor's reply was that *Q* was a measure of the goodness of a coil and the *Q* was for Quality! I wonder if anyone else can recall this definition of *Q*.

Ian Gurton
Harpenden

We received a large number of letters from readers in response to this article, all of them very much along the same lines as the above.

Writing on the usage of Q *in the February 1986* Journal of the IERE, *Professor P. B. Fellgett quoted a reference (Green, E.I., 'The Story of* Q', American Scientist, *p.524, October 1955) which claims that it originated with one K. S. Johnson in the Western Electric Company's Engineering Department (renamed Bell Telephone Laboratories in 1925). In 1914, Johnson, feeling the need for a single symbol for the ratio of reactance to resistance of an inductor, designated it* K. *He renamed it* Q *in 1920, saying that this was because it was the next available letter not already used in the algebraic development. The interpretation of* Q *as 'quality factor' seems to have been a later event, a happy one which may well have aided the symbol's subsequent widespread adoption.*

Lorin Knight pointed out that seismologists use a somewhat similar Quality Factor, Q. *Rock having a high* Q *value sustains seismic vibration for a considerable time, while rock having a low* Q *quickly damps out any vibration.*

When you really start delving into the subject, you soon realise that there are other symbols which are equally obscure in their origin, even among the everyday ones. Why L *for inductance, for example? – Ed.*

Due to pressure on space in this issue of *Radio Bygones*, some of your letters have been unavoidably held over, but will appear in the next issue

BTH (the British Thomson-Houston Co.) and Metro-Vick (Metropolitan-Vickers Electrical Co. Ltd.) both began making valves during WWI, but the brand-name Cosmos was not adopted by the latter for its valves until after the war

MUSEUM PIECES

All valves sold under the Ever Ready Radio Co. Ltd. brand were made for them by Mullard. Mazda was the brand name adopted for valves made by AEI (Associated Electrical Industries Ltd.), a company formed by the merger in 1928 of Ediswan, BTH and Metro-Vick. This more modern carton from Tungsram proudly proclaims it British origins, and carries a picture of the factory. Does any reader recall another product (not radio-related) scathingly said by some to carry a picture of the factory on every packet?

Three lesser-known names from the early days. Louden (1924–25) was a trademark of The Fellows Magneto Co. Ltd. of Park Royal, London NW10. The 362 Radio Valve Co. Ltd., of London E5, marketed a number of valves including a special version of the VP2 for use in the Scott-Taggart ST600 receiver (see the leaflet reproduced below). The Thorpe K4 was a space-charge tetrode, produced in 1924 by Bower Electric Ltd. for use in the Unidyne receiver design

MUSEUM PIECES

The 362 VP 2 - THE VALVE FOR YOUR S.T.600.

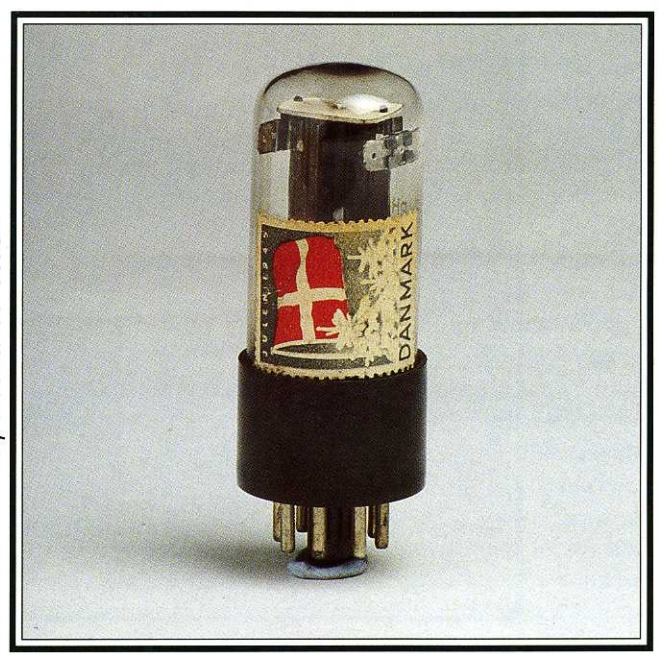
600

To obtain the highest possible efficiency from your S.T.600, or similar circuits, it is essential that the metallising on the HF pentodes be connected to NEGATIVE filament terminal.

362 have again devised a means of ensuring your complete satisfaction by providing a separate connection to the metallising on the VP 2's. The metallising can be connected externally by joining the side terminal to earth.

Fama valves were made in Arnhem, Holland by M. Heussen & Co., and were imported into Britain by H. D. Zealander & Co. in 1925. The carton on the right carries no brand name or information apart from 'Made in Holland'

From the Editor's personal collection



Finally, not a carton but a sticker like a postage stamp, with the Danish flag, snow-covered fir trees and the words 'Julen 1945 DANMARK', on a Philips Miniwatt valve type UY1. Perhaps one of our Scandinavian readers can tell us more