THE AUSTRALASIAN

Radio World

Registered at the G.P.O. Sydney, for transmission by post as a periodical.

1/-

VOL. 10 ..... NO. 7 DECEMBER 15 1945

THE AUSTRALASIAN

RADIO WORLD

Devoted entirely to Technical Radio

and incorporating

ALL-WAVE ALL-WORLD DX NEWS

★ **PROPRIETOR —**
A. G. HULL

★ **Manager —**
DUDLEY L. WALTER

★ **Secretary —**
Miss E. M. VINCENT

★ **Short-wave Editor —**
L. J. KEAST

For all Correspondence

★ **City Office —**
243 Elizabeth St., Sydney
Phone: MA 2325

★ **Office Hours —**
Weekdays: 10 a.m.-5 p.m.
Saturdays: 10 a.m.-12 noon

★ **Editorial Office —**
117 Reservoir Street, Sydney

★ **Victorian Advertising Representative—**
W. J. LEWIS,
20 Queen Street
Melbourne, C1
'Phone: MU 5154

★ **Subscription Rates —**

6 issues	5/3
12 issues	10/6
24 issues	£1

Post free to any address.

★ **Service Departments —**
Back Numbers, 1/- ea. post free
Reply-by-mail Queries, 1/- each

Vol. 10 — DECEMBER, 1945 — No. 7

CONTENTS

EDITORIAL

THE PERSONAL TOUCH

There is another aspect of postwar radio trading which is now making itself felt. It appears that Mrs. Subbubb has been calling in the local radio repairman, Tommy Twistem, and she has become greatly impressed by the way he twiddles the knobs and cocks his head on one side whilst mouthing extraordinary technical phrases. In a nutshell, she has great confidence in his radio knowledge.

Now, Mrs. Subbubb has decided that she needs a new set. Will she buy a "Multiplane Diallo" or a "Synthetic Atomiser?" She won't have either; she insists that Tommy Twistem build her a special set of his own, built just the way he thinks a set ought to be built and put together with the same personal touch that kept the old set in such good form during the war years.

Live radio dealers are making the most of the above set of circumstances, for they may not last long. The war period will soon fade into the dim past, especially when the big factories get their new plans into production, including horrible under-sized, under-powered midgets at retail prices of £10 and less.

Such midgets are awful to contemplate, but apparently represent the heights of ambition to some factories.

A. G. HULL.

ELECTRO-DYNAMICS ARE OBSOLETE

Trade Staggered by Startling Speaker Development

THE Radio Trade is reeling under a stunning announcement from Rola, the big people in Australian loud speaker manufacture, that in future the permagnetic type of speaker will completely supplant the electro-dynamic or energised type of speaker. At the moment there is a helter-skelter rush to amend power transformer ratings and make the other design alterations necessary to use a filter choke instead of a field coil for smoothing.

Some factory technicians are loth to accept the Rola pronouncement, but there is no doubt about Rola being right. The electro-dynamic is doomed. The quicker we all get accustomed to the new technique, the sooner we will appreciate the advantages to be gained.

The Advantages

The use of a permagnetic speaker in an a.c. operated set makes it possible to get full power output with a power transformer having a secondary voltage rating of about 275 volts instead of 385. This means a cheaper and smaller power transformer, as it has less wire and needs only a lighter core. The lower power transformer rating means that the peak voltages throughout the set can never approach those which are encountered in normal sets of today. Less service trouble should be encountered with broken down electrolytics and by-pass-condensers. The load on the rectifier valve, always one of the first to give service trouble, will be lowered.

Still another advantage, from a servicing point of view, will be that should speaker trouble be encountered, the replacement of a speaker unit will not be complicated by the multiplicity of field coil resistance ratings, as at present. With the electro-dynamic there are simply dozens of different field coil resistances used by different set manufacturers. To change over a field coil is not a simple job, so the radio serviceman has to carry a stock of dozens of different speakers to cover the various field coil ratings which may be required. But the permagnetic will reduce the stock problem, as one speaker of each size will be sufficient, it being a matter of minutes to fit the right type of input transformer.

The Matter of Price

The advantages of permagnetics have long been appreciated by far-sighted technicians, but the cost has always been the stumbling block. In the past the permagnetic speaker has been more expensive than its equivalent in the electro-dynamic type. A minor revolution in magnet production practice has now changed all that.

The story is a long one, of course, but to cut it short: a couple of English scientists found that a stronger magnet could be obtained if an "Alnico" magnet was cooled out in a uni-directional magnetic field. Their observations were published in a small way in an English magazine but appeared to escape the notice of those who should have been the most interested. But the article caught the eye of some Dutch scientists, who worked along the line still further. Then came the Germans, who grabbed the Dutch research and the super-magnets were used in German army equipment. Captured equipments went to England and the improved magnets were soon noticed and production methods altered accordingly.

The new magnets are known as "Anisotropic Alnico" (pronounced A-nice-otropic) and are so much lighter in weight for their power that the whole speaker frame can be made of 22 gauge steel instead of 18 gauge, to quote one typical example. This means that the frame can be stamped in two operations instead of eight. All of this means lowered production costs. It is safe to predict that the new permagnetics will be as cheap, or even cheaper, than an electro-dynamic, even taking the cost of the additional filter choke into account.

New Type Speakers

One of the first of the new type permagnetics to be released by Rola will be the type 3C, a speaker with a three-and-a-half inch cone, of particularly light weight and small size, and having a detached input transformer. The retail price of this speaker is expected to be around the pound mark, and will make it the cheapest speaker offered in Australia. An eight-inch model of similar design and performance to the present K8 will follow shortly. The new magnets can be used to great advantage with the big high-fidelity type speakers, it being possible to get a permanent magnet to give a flux density equal to an energised speaker with 100 watts of power in the field. These speakers, however, will not be in production until after the demand for the popular commercial types has been brought under control, and this may take anything from six to twelve months.

THE HAMMOND

THE response to articles written in this journal previously, dealing with electronics applied to music, surprisingly brought forth a gratifying response from a number of our readers. With this fact in mind, the writer takes the liberty of describing what could be termed, perhaps, the most popular of all electronic musical instruments, the Hammond Electric Organ.

This instrument can, indeed, be called remarkable and deserves a great deal more credit and publicity in Australia than it did formerly in pre-war days. This instrument caused a sensation in America in more ways than one. When first placed on the market, the writer is lead to believe that it fell foul of the American Guild of Pipe Organ Builders, who declared that it refused to recognise the Hammond instrument as a legitimate organ. It can only be said that such an attitude approaches the state of lunacy, and is a deliberate attempt to impede the just cause of science, which only seeks to improve existing things.

The writer can only say that, put the Hammond, fitted with its special reverberation chamber alongside a huge one thousand pipe organ and play the same selection with similar playing technique, the writer defies even the most critical listeners to detect the difference. When it can be stated that the price of a large pipe organ costs, in our money, in the region of £30,000, and the Hammond instrument £550, this fact alone makes comparison ludicrous. Take, again, the number of different tonal qualities that may be obtained in each case. In the Hammond organ over 100,000 different tonal qualities may be obtained, by the simple expedient of changing the key selector system; in the case of the pipe organ it requires an individual pipe for each different tonal quality desired. Again, one is readily portable and may be installed by the ordinary radio serviceman with little trouble, the other requires an army of workers, so to speak, to instal it and becomes a physical impossibility in such a place as a small church.

Let it be said then, that Laurens Hammond, the inventor of the Hammond Organ, has done a remarkable job to mass produce an electronic instrument such as this, at such a reasonable figure, thus providing a really economical instrument within reach of the average person who earns a living per medium of the musical profession. Having made a brief comparison of the old and the new serve as an introduction, we can proceed with the description of the operation of the Hammond instrument.

Firstly, to dispel the popular belief by many that the Hammond organ uses vacuum tubes for the

Ref. Char. of Key	Ref. Char.	No. of High Points	n ROTOR: Driving Gear of n Rotor: Ref. Char.	n ROTOR: Driving Gear of n Rotor: No. Teeth	n ROTOR: Driven Gear for n Rotor: Ref. Char.	n ROTOR: Driven Gear for n Rotor: No. Teeth	Frequency of Current Generated	Theoretical Frequency of Note in Equally Tempered Musical Scale A-440	Ref. Char. of 2n Rotor	" " 3n "	" " 4n "	" " 5n "	" " 6n "	" " 8n "
C_0	1	2	102	85	132	104	32.692	32.703	13	20	25	29	32	37
$C^\#_0$	2	2	109	71	139	82	34.634	34.647	14	21	26	30	33	38
D_0	3	2	104	67	134	73	36.712	36.708	15	22	27	31	34	39
$D^\#_0$	4	2	111	70	141	72	38.888	38,890	16	23	28	32	35	40
E_0	5	2	106	69	136	67	41.194	41,203	17	24	29	33	36	41
F_0	6	4	101	54	131	99	43.636	43.653	18	25	30	34	37	42
$F^\#_0$	7	4	108	37	138	64	46.250	46.249	19	26	31	35	38	43
G_0	8	4	103	49	133	80	49.000	48.999	20	27	32	36	39	44
$G^\#_0$	9	4	110	48	140	74	51.891	51.913	21	28	33	37	40	45
A_0	10	4	105	66	135	96	55.000	55.000	22	29	34	38	41	46
$A^\#_0$	11	4	112	67	142	92	58.260	58.270	23	30	35	39	42	47
B_0	12	4	107	54	137	70	61.714	61.735	24	31	36	40	43	48
C_1	13	4	102	85	132	104	65.384	65.406	25	32	37	41	44	49
$C^\#_1$	14	4	109	71	139	82	69.268	69.295	26	33	38	42	45	50
D_1	15	4	104	67	134	73	73.424	73.416	27	34	39	43	46	51
$D^\#_1$	16	4	111	70	141	72	77.777	77.781	28	35	40	44	47	52
E_1	17	4	106	69	136	67	82.388	82.406	29	36	41	45	48	53
F_1	18	8	101	54	161	99	87.272	87.307	30	37	42	46	49	54
$F^\#_1$	19	8	108	37	168	64	92.500	92.498	31	38	43	47	50	55
G_1	20	8	103	49	163	80	98.000	97.998	32	39	44	48	51	56
$G^\#_1$	21	8	110	48	170	74	103.783	103.826	33	40	45	49	52	57
A_1	22	8	105	66	165	96	110.000	110.000	34	41	46	50	53	58
$A^\#_1$	23	8	112	67	172	92	116.521	116.540	35	42	47	51	54	59
B_1	24	8	107	54	167	70	123.428	123.470	36	43	48	52	55	60
C_2	25	8	102	85	162	104	130.769	130.812	37	44	49	53	56	61
$C^\#_2$	26	8	109	71	169	82	138.536	138.591	38	45	50	54	57	62
D_2	27	8	104	67	164	73	146.849	146.832	39	46	51	55	58	63
$D^\#_2$	28	8	111	70	171	72	155.555	155.563	40	47	52	56	59	64
E_2	29	8	106	69	166	67	164.776	164.813	41	48	53	57	60	65
F_2	30	16	101	54	161	99	174.525	174.614	42	49	54	58	61	66
$F^\#_2$	31	16	108	37	168	64	185.000	184.997	43	50	55	59	62	67
G_2	32	16	103	49	163	80	196.000	195.997	44	51	56	60	63	68
$G^\#_2$	33	16	110	48	170	74	207.567	207.652	45	52	57	61	64	59
A_2	34	16	105	66	165	96	220.000	220.000	46	53	58	62	65	70
$A^\#_2$	35	16	112	67	172	92	233.043	233.081	47	54	59	63	66	71
B_2	36	16	107	54	167	70	246.857	246.941	48	55	60	64	67	72
C_3	37	16	102	85	162	104	261.538	261.625	49	56	61	65	68	73
$C^\#_3$	38	16	109	71	169	82	277.073	277.182	50	57	62	66	69	74
D_3	39	16	104	67	164	73	293.698	293.664	51	58	63	67	70	75
$D^\#_3$	40	16	111	70	171	72	311.111	311.126	52	59	64	68	71	76
E_3	41	16	106	69	166	67	329.552	329.627	53	60	65	69	72	77
F_3	42	16	113	84	173	77	349.090	349.228	54	61	66	70	73	78
$F^\#_3$	43	16	120	74	180	64	370.000	369.994	55	62	67	71	74	79
G_3	44	16	115	98	175	80	392.000	391.995	56	63	68	72	75	80
$G^\#_3$	45	16	122	96	182	74	415.135	415.304	57	64	69	73	76	81
A_3	46	16	117	88	177	64	440.000	440.000	58	65	70	74	77	82
$A^\#_3$	47	16	124	67	184	46	466.086	466.163	59	66	71	75	78	83
B_3	48	16	119	108	179	70	493.714	493.883	60	67	72	76	79	84
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)

Fig. 28.

ELECTRIC ORGAN -- BY CHAS. MUTTON

production of musical tones, this is definitely not the case. The only tubes used in the instrument are those contained in the standard Hammond amplifier, consisting of two 56's transformer coupled to four push-pull parallel 2A3's, which drive two Rola G12 speakers in parallel, plus two tubes in the pre-amplifier, which serves to boost the low output from the tone generators.

To grasp the operation of this instrument clearly let us revert to a few musical fundamentals. Firstly, any musical sound is composed of a fundamental tone of certain amplitude plus different harmonics of various amplitudes, these harmonics being sub-multiples of the fundamental. In studying music, it can be said that in most musical tones the most noticeable harmonics are those of the lower frequencies, and that any harmonic in excess of the eighth has a negligible effect on the character of the produced tone. When considering the higher frequencies of the tempered musical scale, say, in the regions of 400 cps, it will be realised that the higher harmonics will be inaudible, due to the limitations of the human ear.

Just as a simple example, take two different instruments: the piano and the violin. Sound middle C on the piano, which corresponds to 261.625 c.p.s.; now take the same tone played on the violin, both elements are vibrating at 261 cycles per second, but why the great difference in tone character? The answer is simply this: that the harmonic content in each case is different. So we remember always that the harmonic content of a sustained musical note is largely responsible for the characteristic of the produced tone.

Thus by providing some means of mixing the fundamental tone with various proportions of the various harmonics up to and including the eighth, most of the musical tones may be produced. This, then, is the principle on which the Hammond Organ works.

Ref. Char. of Key (1)	n Rotor: Ref. Char. (2)	n Rotor: No. of High Points (3)	n Rotor: Driving Gear for n Rotor: Ref. Char. (4)	n Rotor: Driving Gear for n Rotor: No. Teeth (5)	n Rotor: Driven Gear for n Rotor: Ref. Char. (6)	n Rotor: Driven Gear for n Rotor: No. Teeth (7)	Frequency of Current Generated (8)	Theoretical Frequency of Note in Equally Tempered Musical Scale A-440 (9)	Ref. Char. of 2n Rotor (10)	" " 3n " (11)	" " 4n " (12)	" " 5n " (13)	" " 6n " (14)	" " 8n " (15)
C4	49	16	114	85	174	52	523.076	523.251	61	68	73	77	80	85
C#4	50	16	121	71	181	41	554.146	554.365	62	69	74	78	81	86
D4	51	16	116	134	176	73	587.397	587.329	63	70	75	79	82	87
D#4	52	16	123	105	183	54	622.222	622.253	64	71	76	80	83	88
E4	53	16	118	103	178	50	659.200	659.255	65	72	77	81	84	89
F4	54	32	113	84	173	77	698.181	698.456	66	73	78	82	85	—
F#4	55	32	120	74	180	64	740.000	739.988	67	74	79	83	86	—
G4	56	32	115	98	175	80	784.000	783.991	68	75	80	84	87	—
G#4	57	32	122	96	182	74	830.270	830.609	69	76	81	85	88	—
A4	58	32	117	88	177	64	880.000	880.000	70	77	82	86	89	—
A#4	59	32	124	67	184	46	932.173	932.327	71	78	83	87	—	—
B4	60	32	119	108	179	70	987.428	987.766	72	79	84	88	—	—
C5	61	32	114	85	174	52	1046.153	1046.502	73	80	85	89	—	—
C#5	62	32	121	71	181	41	1108.292	1108.730	74	81	86	—	—	—
D5	63	32	116	134	176	73	1174.794	1174.659	75	82	87	—	—	—
D#5	64	32	123	105	183	54	1244.444	1244.507	76	83	88	—	—	—
E5	65	32	118	103	178	50	1318.400	1318.510	77	84	89	—	—	—
F5	66	64	113	84	143	77	1396.363	1396.912	78	85	—	—	—	—
F#5	67	64	120	74	150	64	1480.000	1479.976	79	86	—	—	—	—
G5	68	64	115	98	145	80	1568.000	1567.982	80	87	—	—	—	—
G#5	69	64	122	96	152	74	1660.540	1661.218	81	88	—	—	—	—
A5	70	64	117	88	147	64	1760.000	1760.000	82	89	—	—	—	—
A#5	71	64	124	67	154	46	1864.346	1864.654	83	—	—	—	—	—
B5	72	64	119	108	149	70	1974.856	1975.532	84	—	—	—	—	—
C6	73	64	114	85	144	52	2092.306	2093.004	85	—	—	—	—	—
—	74	64	121	71	151	41	2216.584	2217.460	—	—	—	—	—	—
—	75	64	116	134	146	73	2349.588	2349.318	—	—	—	—	—	—
—	76	64	123	105	153	54	2483.888	2489.014	—	—	—	—	—	—
—	77	64	118	103	148	50	2636.800	2637.020	—	—	—	—	—	—
—	78	128	113	84	143	77	2792.727	2793.824	—	—	—	—	—	—
—	79	128	120	74	150	64	2960.000	2959.952	—	—	—	—	—	—
—	80	128	115	98	145	80	3136.000	3135.964	—	—	—	—	—	—
—	81	128	122	96	152	74	3321.080	3322.436	—	—	—	—	—	—
—	82	128	117	88	147	64	3520.000	3520.000	—	—	—	—	—	—
—	83	128	124	67	154	46	3728.693	3729.308	—	—	—	—	—	—
—	84	128	119	108	149	70	3949.713	3951.064	—	—	—	—	—	—
—	85	128	114	85	144	52	4184.613	4186.008	—	—	—	—	—	—
—	86	128	121	71	151	41	4433.169	4434.920	—	—	—	—	—	—
—	87	128	116	134	146	73	4699.177	4698.636	—	—	—	—	—	—
—	88	128	123	105	153	54	4977.777	4978.028	—	—	—	—	—	—
—	89	128	118	103	148	50	5273.600	5274.040	—	—	—	—	—	—

Fig. 28a

General Outline

The Hammond organ comprises a console, having two keyboards, correctly termed manuals, each having 61 notes. One manual having keys which cover the tempered scale, the other covering the notes for the upper half of the scale. In addition there is also a pedal keyboard covering a limited range of bass notes, ranging from 32 cycles up. The instrument produces sine waves of the desired frequency and a synthetic means is provided whereby the various harmonics are mixed in the desired proportions to produce a desired tonal quality. The currents generated are of low voltage and amperage and and fed through a step up transformer to the main amplifier and translated by the speakers into sound.

The Tone Generator

The generation of the tones of the tempered musical scale are produced by a total of 89 different rotating wheels, some being different in shape to others, actually there are seven different shapes in all. To clarify subsequent statements, we

(Continued on next page)

HAMMOND ORGAN

(Continued)

will call the assembly of the rotor, plus the magnet and pick up coil the "alternator," whereas the toothed wheel which moves past the pole piece is just termed a "rotor." Thus we can see that for each note required in the instrument we have a different alternator. A means is also provided for adjusting the distance between the pole-piece of the pick-up coil associated with each alternator and its own rotor, thus enabling the individual output of each alternator to be equalised, so that the sound intensity of each note is the same. This becomes necessary, due to the fact that as the frequency increases the impedance of the tone generators increases, giving rise to greater output at the high frequencies than at the lower frequencies, in addition to the aforementioned adjustment, the coils of the generators of lower frequencies are wound with a greater number of turns than those for the higher frequencies.

Rotor Speeds

All the rotors are driven at a constant speed by a synchronous electric motor, rotating at approximately 750 r.p.m., which may be supplied from the mains with alternating current or from a DC source by using a tuning fork interrupter which converts steady DC to pulsating DC.

The main driving shaft, called the countershaft, is connected to the synchronous motor by means of a highly flexible coupling. The countershaft is split up into sections which are coupled together by a simple universal joint and each section of the countershaft has a number of driving gears attached to it. These driving gears in turn mesh with two driven gears, one each side of the driving gear, and these two driven gears are mounted for rotation on rotor shafts, and are flexibly connected to rotate the latter through a very light spring.

With regard to the different shapes of the rotors employed, seven is the number; the number of high points are 2, 4. 8, 16, 32, 64 and 128 respectively. Usually there are two rotors upon each rotor shaft, although in some instances there is only one.

The Key Mechanism

Associated with each key in the Hammond organ, there is a multi-contact switch. When any one of the keys on either manual is depressed, the switch associated with that key closes a circuit to seven different generators at once; these generators developing currents of the fundamental frequency plus the 2nd, 3rd, 4th, 5th, 6th and eighth harmonic of the fundamental. These generators in turn are connected via the key circuits to a number of busbar conductors, seven in all. One bus bar to receive all the fundamental tones and one for each of the harmonics. These bus bars are in turn connected through a selector device in the form of slider bars, which are in effect single pole seven position switches, but are made with the slider bar construction to conform with usual organ practice and are somewhat similar to the familiar organ stops. As these slider bars are pulled out a series of numbers may be seen, numbered from one to eight, the purpose of this being so that the organist, on finding a particular tonal quality to his liking, he may memorise the number combination for future use. The purpose of this selector system is to provide a means whereby the currents generated by certain generators on depression of one or more keys are passed through a selected number of turns of an output transformer. Thus any one of the seven bus bars may be, through the selector device, connected to any desired tap on the primary of the output transformer. Generally speaking the apparent increase in intensity of a musical tone does not vary directly with the increase in energy utilised in propagating the tone, hence the primary of the transformer is tapped at intervals of increasing numbers of turns, so that the apparent loudness of a musical tone may be increased in apparently regular steps through a geometrically increasing number of turns of the primary of the transformer. It is only necessary to be familiar with turns ratio action in any transformer to make the above facts readily understandable.

Harmonic Proportions

Thus, within reason, musical tones of any desired quality may be produced at will by proper selection ad proper proportioning of the output of the fundamental tone and the output of the various harmonics. In other words, we take, say, seven individual sine waves, superimpose one upon the other and then, by means of the selector system, we can make either of the six harmonics predominate, or the fundamental can be made to predominate over any of the harmonics, and yet again the harmonics can be all or singly set at a predetermined proportion in the final complex wave form. This is commonly called synthesis of musical tones or, in other words, the various tonal qualities are synthetically produced.

Elimination of "Robbing"

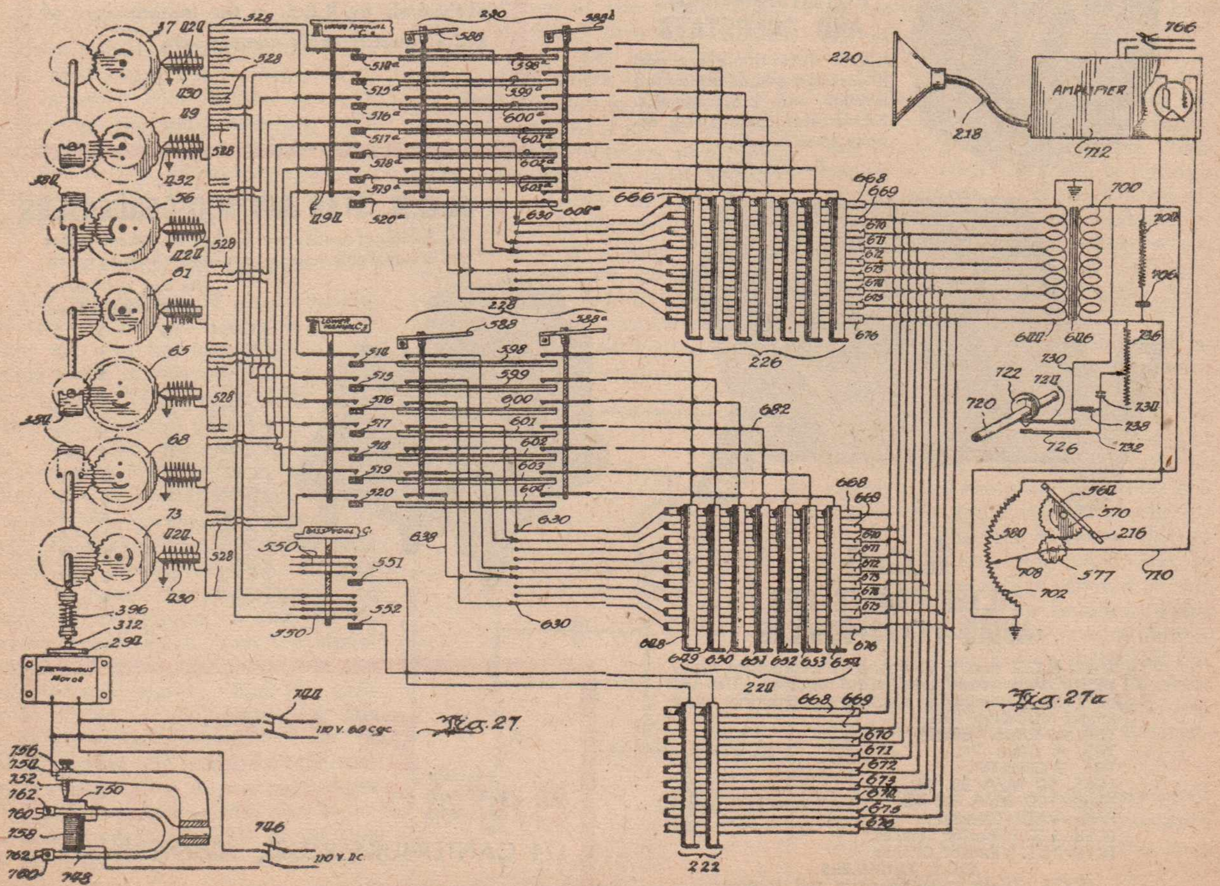
Delving into the design of the Hammond a little further take, for instance, the note "A" above middle "C", this note generates a frequency of 440 cycles per second and on the depression of its own key we have in the output A 440 the fundamental 880 c.p.s. 2nd partial — 1318.4 c.p.s., 3rd partial—1760, 4th—2216.584, 5th—2636.8, 6th and 3520 c.p.s., the seventh partial. Now by referring to the chart reprinted in the article we can see that the note A 440, or any other for that matter, can be used a number of times for different purposes.

If, for instance, we sounded the note A, which is 2 octaves below middle C, this would correspond to a frequency of 110 cycles p.s. Then A 440 would become the fourth partial, or harmonic, of the lowerA, and if we desired to play the two notes simultaneously, A 440 generator would need to supply twice the output. In order to avoid any one note robbing the other when two or more notes are played together isolating resistances are used of 15 ohm resistance. There may be anything up to 6 or 7 of these in series with each 4 ohm generator winding, each branching off to the various harmonic notes and also to the upper manual and to the bass pedals. So we see that although we have three keyboards to supply with one set of alternators, the circuit arrangement is such that if current from a single generator is necessary for the production of partials in a plurality of tones when a number of keys are depressed simultaneously, the generator will supply increased energy to the primary of the transformer, depending upon the number of times that current of that particular frequency is present either as a fundamental or a harmonic. And since all the current of a certain frequency is supplied from the same alternator, the currents are in synchronism and in phase. Which means that chords may be played upon the instrument while retaining the true tone quality of the individual notes composing the chord.

The Output Circuit

The bus bars mentioned previously, seven in number, are connected to the taps on the primary of the output transformer. The total impedance of the primary is one ohm and has a total of 64 turns, which are tapped at 6 — 8 — 11 — 16 — 22 — 32 — 45 and 64. The secondary winding is designed to match the grid of the 57 pre-amplifier tube and has approximately 447 times the number of turns of the primary. Across the secondary

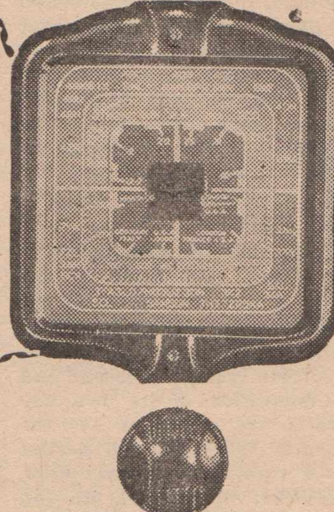
(Continued on page 25)



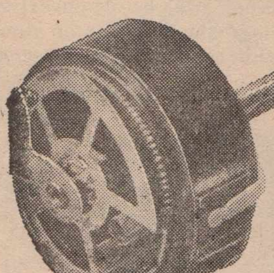
A Schematic Explanation of the Hammond Electric Organ.

Back Again!

THE POPULAR R.C.S DA7 RADIO DIAL



TROLITUL — a semi-transparent, light-weight moulded insulating plastic — is used exclusively by R.C.S. in the manufacture of R.C.S. quality radio components.



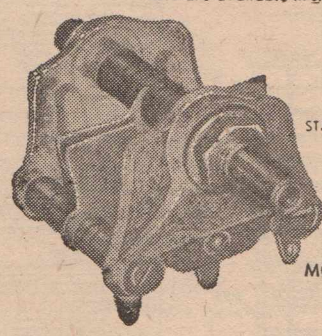
R.C.S. POTENTIOMETERS AND RHEOSTATS

R.C.S. Potentiometers and Rheostats are made of moulded bakelite, with brass spindles. Nickel silver contact ring ensures smooth action.

0–10000 Ohms.

R.C.S. STAR AND M/C CONDENSERS

R.C.S. Midget condensers feature Trolitul end plates and are available in single and double bearing types.



		Max. Cap. MMFD.	Min. Cap. MMFD.	Plates
STAR	CV34	10	3	2
	CV35	15	3	3
	CV36	25	3.5	4
	CV37	35	4	5
	CV38	50	4	7
	CV39	70	5	9
	CV40	100	6	14
MC	CV41	10	3	2
	CV42	15	3	3
	CV43	25	3.5	4
	CV44	35	4	5
	CV45	50	4	7
	CV46	70	5	9
	CV47	100	6	14

R.C..S FILTER CHOKES AND AUDIO TRANSFORMERS

These R.C.S. quality components incorporate heavy copper wire wound on Trolitul bobbins. The use of Trolitul eliminates electrolysis, ensuring much longer effective life.

TB4. A Class. Single.
TB5. A Class PP.
TB6. B Class PP.
TC65. 50 M/A 30. H.
TC60. 100 M/A 30 H.
TA4. Audio Chokes.
TC58. L.T. Vibrator Chokes.
TC70. H.T. Vibrator Chokes.

R.C.S. TRIMMERS

R.C.S. Trimmers—Two-plate coil trimmers mounted on Trolitul base.

R.C.S. RADIO PTY. LTD.

174 CANTERBURY ROAD, CANTERBURY.

HINTS ABOUT USING A.V.C.

AUTOMATIC volume control, abbreviated A.V.C., would be more correctly termed automatic gain control, as it is the gain of the high frequency amplifiers of the receiver that is automatically varied, and not the audio section. This variation in gain produces a result of a reasonable constant audio output, which possibly accounts for the name, or more probably its greater selling appeal.

It will be shown that when a strong signal is being received, a negative bias is developed and ap-

By

CHARLES ASTON

21 William Street
Double Bay

plied to the R.F. or I.F. amplifying valves, reducing their gain. When the signal strength decreases (fades) the negative bias will be reduced, increasing the gain resulting in a fairly constant signal voltage being applied to the detector, or second detector, with its obvious advantages.

Variable-mu Valves

The remote cut-off characteristic of the variable-mu valves makes it very suitable for use as an amplifying valve to which an A.V.C. bias is applied. This property is illustrated in the form of a curve in Fig. 1, where the mutual conductance curves of a valve with a relatively sharp cut-off and one with a remote cut-off are compared. Curve (b) with its sharp cut-off requires only relatively small variation in grid volts to cause the plate current to vary between maximum and cut-off, which means that a fairly low signal input will drive the valve into the positive grid region, which is a condition to be avoided. Curve (a) has a much more gradual decrease in plate current and in this instance requires about two and a half times the grid bias of the other to reach cut-off point. The result of all this is the control grid has a "vernier" action over the current passing through the valve and requires a greater signal input before the valve is overloaded; this lends the variable-mu valve to be used as an amplifier with a gain that is conveniently varied.

R.F. Component

A diode valve is a very suitable rectifier of the R.F. current to produce A.V.C. bias voltages, and it is convenient to utilise the rectified R.F. component that is produced during the detection process of the second detector of a superhet which almost always consists of a diode detector, owing to its ability to handle large signal inputs without introducing distortion, and the fact that it is a linear detector which also makes it particularly useful as a source of A.V.C. bias voltage, as it is necessary to produce voltages as high as thirty or forty.

The linear characteristic means the amplitude of the rectified R.F. will be in direct proportion to the ampltitude of the signal input to the receiver, which is the total signal EMF induced in the aerial, and should be at least 5 uV at the aerial terminal for satisfactory programme level, even with the most sensitive receivers and may, in fact, lie between the wide limits of 1 and 1,000,000 uV (1 volt), which, of course, depends on several factors such as the proximity and power radiation of the transmitter.

An A.V.C. system that is capable of producing a programme with 1

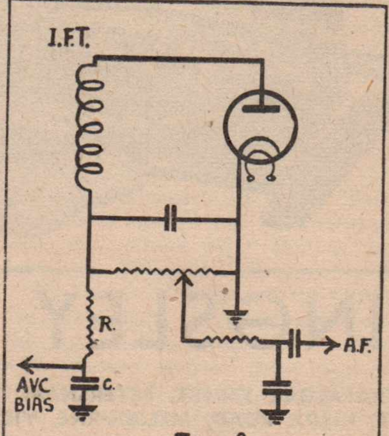


Fig.2.

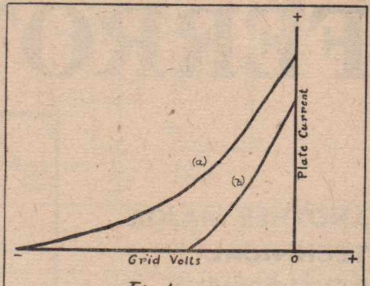


Fig.1.

to 4 variation from the speaker with a signal input to the receiver varying anything between 5 to 500,000 uV is considered satisfactory.

A.V.C. Voltages

A simple diode detector is shown in Fig 2 (a), but its action for producing A.F. currents will not be described here, as we are interested in its ability in producing A.V.C. bias voltages.

The wave is applied across the cathode and plate of the diode by the secondary of the I.F. transformer. During the conductive half cycles — when the plate is positive to the cathode — there will be an electron flow from the cathode to plate, through the secondary winding of the I.F. transformer, then through the condenser-resistor combination back to the cathode. There will, of course, be a voltage drop across the resistor-condenser combination, and as an electron flow is equivalent to a current flow in the opposite direction the earthed end connected to the cathode will be positive and the other negative. The higher the signal applied to the diode the higher the negative voltage developed across the load, and as the signal strength is reduced so this negative voltage is reduced. Actually the whole action is very similar to a half-wave power rectifying device, the main difference in principle being that the negative is isolated from earth instead of the positive.

As there is only a relatively small flow of current the load resistance should be about 500,000 ohms, so a

(Continued on page 13)

A.V.C.

(Continued)

sufficiently high voltage is developed. The associated condenser will have a value of about .0001 ufd.

Filter Circuit

The voltage developed across the load resistance will be varying at audio frequencies when a modulated wave is being received, and if it was applied directly to the grids of the controlled valves their gain would be varied in a manner that would cancel the modulation of the carrier. A filter circuit consisting of a resistance R and condenser C, included in the circuit prevent the audio variations appearing in the bias voltage without affecting the variations produced by a varying signal input. The value of the resistor is somewhere between say, half and one megohm, and the condenser .05 and .1 umf. These values are limited by the "time constant" which is present in all circuits where a condenser is being charged through a resistance.

Filter Action

As there is no current flow through the filter system no voltage drop of the A.V.C. bias will appear across R (the grids do not draw current), this permits the use of a high resistance which would not be otherwise possible. The impedance of C at audio frequencies is so low that the end of R may be regarded as being connected to earth at these frequencies and as R presents a high impedance to them they will be developed across it and the "earthed" end is at zero A.F., and the other end at maximum A.F. potential, which is where it is required. The result being that the A.F. variations

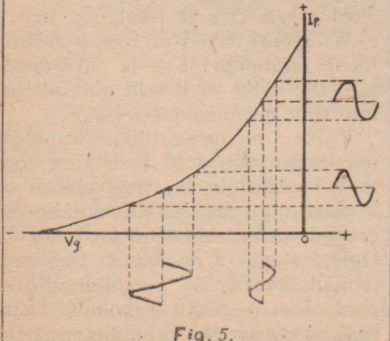


Fig. 5.

are filtered from the A.V.C. bias voltage.

Time Constant

A voltage connected to a series condenser and high resistance take a definite period of time to charge the condensor and the time taken for the condenser to reach 63 per cent of its final charge after the voltage is applied is known as the "time constant" of the resistance-capacity circuit. The formula for determining the time constant is the resistance in megohms multiplied by the capacity in microfarads, the answer being in seconds. If the resistance is 1 megohm and the capacity 1 micrafarad, the time constant is 1 second, and if the voltage applied across them is 100 the condenser will develop a charge of 63 per cent of this, which in this case, will be 63 volt. If 1 volt only was applied the charge would be 0.63 volts.

The time constant of the A.V.C. bias filter plays an important part in the results obtained and as shown

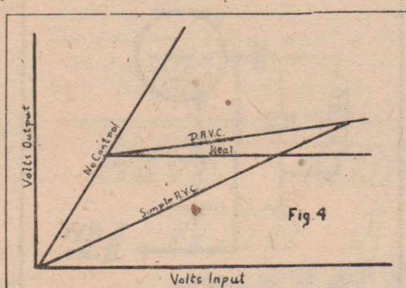


Fig. 4

previously the component values have to be fairly high to provide sufficient filtering; this involves a relatively large time constant and means that the A.V.C. voltage does not immediately appear on the grids of the controlled valves, but a period of time later depending on the time constant of the circuit, thus there is a time delay between a variation in signal strength and the applying of the compensating bias on the grids of the controlled valves. This time delay should not be confused with the voltage delay that is inferred by "delayed A.V.C."

The larger the values of the filtering components the greater will be the time delay, while the smaller will produce shorter delay and a compromise design is satisfactory. Also the service for which the receiver is to be used must also be considered and where considerable

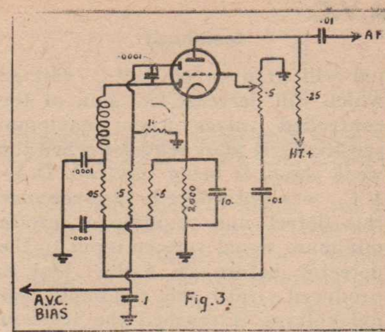


Fig. 3.

fading is expected a reduction of the low note response may be tolerated to obtain the advantage of a short time delay. Suggested time delays are 0.25 to 0.5 seconds where good fidelity is required; 0.1 to 0.3 seconds for average broadcast receivers; 0.1 to 0.2 seconds for receivers incorporating short wave reception; for ideal A.V.C. action between 0.04 and 0.09 seconds.

A.F. Affected

Too short a time constant does not permit sufficient filtering of the A.F. from theA.V.C. voltage. This is particularly true for the lower A.F., say, between 30 an d200 c.p.s. which results in the introduction of distortion by the controlled valves, a condition that may be tolerated in communication type receivers, but hardly in the variety labelled high-fidelity.

When a long time delay is used another undesirable effect occurs which partially nullifies the advantage of reducing blasting when tuning contained in receivers fitted with A.V.C. When tuned to a weak station the A.V.C. bias will be at a minimum and the receiver will be in its most sensitive condition, and if it is then tuned quickly to a powerful local station the filter condenser will take an appreciable time to charge, during which the receiver will be still operating in a sensitive condition. When retuning after a powerful station the filter condensor will take an appreciable time to discharge, during which the receiver will be in an insensitive condition and it would be quite possible to tune past a weak station.

Delayed A.V.C.

With the simple type of A.V.C. as shown in Fig. 2, even a weak sig-

(Continued on next page)

A.V.C.

(Continued)

nal will produce an A.V.C. voltage which will decrease the gain of the controlled valves when maximum sensitivity is most required when the weak signal is being received. D.A.-V.C. was introduced to overcome this defect and requires a certain minimum signal voltage input to the detector before an A.V.C. bias is produced. Until this minimum signal voltage is reached the receiver will operate as one without A.V.C. and at maximum sensitivity.

It is well known that a valve will not pass current unless the plate is positive with respect to the cathode. By making the cathode of the A.V.C. rectifier, say, 3 volts positive to the plate a signal with an amplitude greater than 3 volts will have to be applied across the diode before it will be conductive and until this condition exists there will be no development of an A.V.C. bias voltage and the delay of the circuit will be 3 volts in this instance.

It is evident that the same diode cannot be used in the dual use of detector and D.A.V.C. rectifier for the detector would be inoperative until the positive cathode voltage is exceeded. Two diodes are often contained in the one envelope for the purpose of performing the functions of D.A.V.C. rectifier and detector, and it is common for a triode or pentode valve to be included in this envelope so it maw also perform the operation of either an I.F. amplifier, before being applied to the diodes, or as an A.F. amplifier after the detection process.

Typical Circuit

A typical circuit utilising duo-diode triode as a detector, D.A.V.C. rectifier, and audio amplifier is shown in Fig.3. The delay voltage is conveniently obtained by using the voltage drop across the cathode biasing resistor making the delay voltage equal to the bias of the triode section. The voltage drop across cathode resistor makes the cathode positive to the D.A.V.C. rectifier plate which fulfils the requirements for a delay voltage.

In Fig. 3 average component values are shown, the coupling condenser between the A.V.C. diode plate should not be increased beyond .0001 ufd., but the other components are not at all critical.

Fig. 4 depicts a series of approximate curves of the controlling effect of simple A.V.C., delayed A.V.C., and the ideal case. Also included is the no control characteristic. It can be seen that the D.A.-V.C. closely approximates the ideal, and as long as it does not depart too much from this is considered satisfactory.

It is also evident that at low inputs D.A.V.C. produces greater gain than the simple system.

Controlled Stages

The result of providing A.V.C. bias to a variable-mu valve is illustrated in the mutual characteristic curve of Fig. 5. As the signal strength varies, so the operating point of the valve is altered, producing a substantially constant output.

The number of stages controlled greatly varies the effectiveness of the system. Naturally the greater number of controlled stages the more effective the result.

It is not always desirable that all stages be controlled as distortion introduced by "modulation rise" may result. This effect may be re-

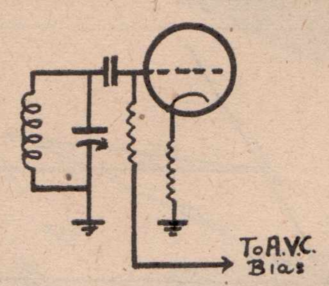


Fig.6b

duced by feeding the final I.F. amplifier with a reduced A.V.C. voltage tapped off the A.V.C. load resistance.

Two methods are in general use for applying the A.V.C. bias voltage to the grids of the controlled valves — series feed Fig. 6a and shunt feed, Fig. 6b.

Series Feed

The A.V.C. voltage is fed through the inductance connected to the grid of the controlled valve, as in Fig. 6a. The end of the tuning inductance remote to the grid is connected through a condenser having a low impedance to either the R.F. or I.F. involved, so the tuned resonant circuit is substantially unaffected by the insertion of this condenser. This remote end of the inductance is also fed through a relatively high resistance by the A.V.C. bias voltage. The capacity-resistance has a time

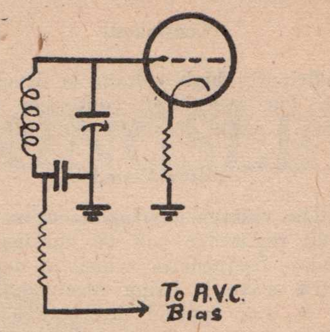


Fig.6a.

constant following the same laws as previously explained. It is desirable to include the resistances in the circuit to prevent undesirable coupling between the R.F. and I.F. stages which may produce instability.

Shunt Feed

With shunt feed the A.V.C. bias is applied directly to the grid of the controlled valve through about a .5 megohm resistor. The voltage is prevented from being shorted to earth through the tuning inductance by isolating the tuning circuit with a fixed condenser of about a .0001 ufd. value from the grid circuit. This resistance, or grid leak, in shunt with the tuned circuit will introduce a certain amount of damping, but this is practically negligible with the average tuned R.F. circuit. The effect on the I.F. stage is somewhat more apparent, and it is more desirable to use series feed with this amplifier.

When shunt feed is used it is usually only applied to the R.F. stages, and the series feed applied to the I.F. amplifiers, as a combination.

Shunt feed has the advantage of a greatly reduced time constant, although this system is more liable to grid blocking and should not be used when this is likely to occur.

With both types of feed a certain fixed minimum bias is introduced into the valve so it will not fall below this recommended value.

Valve manufacturers stipulate maximum values of resistance that may be used in the grid circuit of a valve, and this should not be exceeded, and recommend for one controlled stages 3 megohms; two controlled stages, 2.5 megohms; three controlled stages, 2 megohms. These resistances are the value between the grid and the cathode of any valve.

MUTTON THE WINNER

VICTORIAN AMPLIFIER CHAMPIONSHIP RESULT

CHARLIE MUTTON, our popular contributor on the subject of amplifiers, showed that he knows what he is writing about by a runaway win in the Victorian Amplifier Championship Contest, winning also the first prize in Grade I for professionals.

The final hearing of the contest was heard in the Melbourne Town Town Hall on November 14. A big crowd of rabid enthusiasts attended and heard many fine amplifiers, but Charlie Mutton's was outstanding, even in such class.

In the professional grade there were four finalists, as detailed in last month's issue. The audience heard the first three in silence, but after Charlie Mutton's amplifier had performed fourth, the crowd gave a spontaneous burst of applause. It is always a good sign for an amplifier when a crowd is moved to clap a recording, and sure enough, the official judges declared Charlie the winner of the Professional Grade. An amplifier entered and operated by Mr. and Mrs. McLean was second. Third place went to Mr. Hutchinson.

The Amateur Class

Three finalists played off in the Amateur Grade, and some fine reproduction was given by these. The winner was Mr. Keogh, second Mr. Hutchinson and third, Mr. Groves. Winning third place in this grade was a single-ended amplifier, consisting of a 6J7G driving a single 2A3, and it gave such good performance that it was not surprising that it readily won the next section of the contest, it being for single-ended amplifiers only. Second place in this class was won by a direct-coupled amplifier entered by Mr. Alexander, and third prize went to Mr. Wilkins.

Club Members Grade

Next on the programme were the three finalists in the grade open to members of the Australian DX Radio Club only. An interesting amplifier in this grade was a cathode-follower job with cathode coupling both in the second stage as well as the output stage. It gave excellent performance, but could only run second to Mr. Hutchinson, who also won second prize in the Amateur Grade and third in the Professional. Third prize for Club Members went to Mr. Groves.

The Champion of Champions

Then came the grand final, three amplifiers competing for the honour of being declared the Champion Amplifier of Victoria. The finalists were Mutton, Keogh and Hutchinson in that order and that was how the judges placed them. For this final the three competitors all played the same recording and gave the audience an excellent opportunity of making direct comparison between the three amplifiers.

Great Success

The contest was a great success in every way and reflects much credit on the organisers and judges. The audience had to stand a fairly solid ear bashing at the final (what with frequency test records and such) but most of them were obvious amplifier "cranks" and could stand it. Next year a possibility might be to get the complete judging of the various grades in private and bring forth the grade winners to demonstrate their performance in public, then picking the Champion from among them by means of a composite voting system for audience, technical judges, and musical judges.

Circuit Details

Details of the circuits used by the finalists were given in last month's issue. A full description of the winning amplifier will appear in next month's issue.

Personal

Mr. and Mrs. McLean received congratulations on the reproduction of their amplifier, but even more congratulations on their personal reproduction — a four-year-old daughter of exquisite charm.

SOME PRACTICAL EXPERIMENTS

THE "LAMB" NOISE SUPPRESSOR

Its theory and construction, with comments, in regard to its advantages and disadvantages.

OVER the past few years the writer has performed some experimental work in connection with the elimination of man-made and atmospheric static in radio reception, particularly where short wave signals are concerned At the situation where the above experiments were carried out, static of all kinds is predominant. Vacuum cleaners, refrigerators and electric sewing machines run con-

By

J. G. DUFAUR

B.E., A.M.I.E. (Aust.), A.M.I.R.E. (Aust.)

tinually in adjacent flats and the continual snapping of power and light switches cause a succession of thumps in the receiver. Electric trains run to and fro a few hundred yards away and a stream of traffic setting up most unpleasant ignition interference passes the door.

One method to help combat interference such as this, has been the construction of a Lamb Noise Suppressor and the following notes in this connection may interest some of those who are troubled with interference problems.

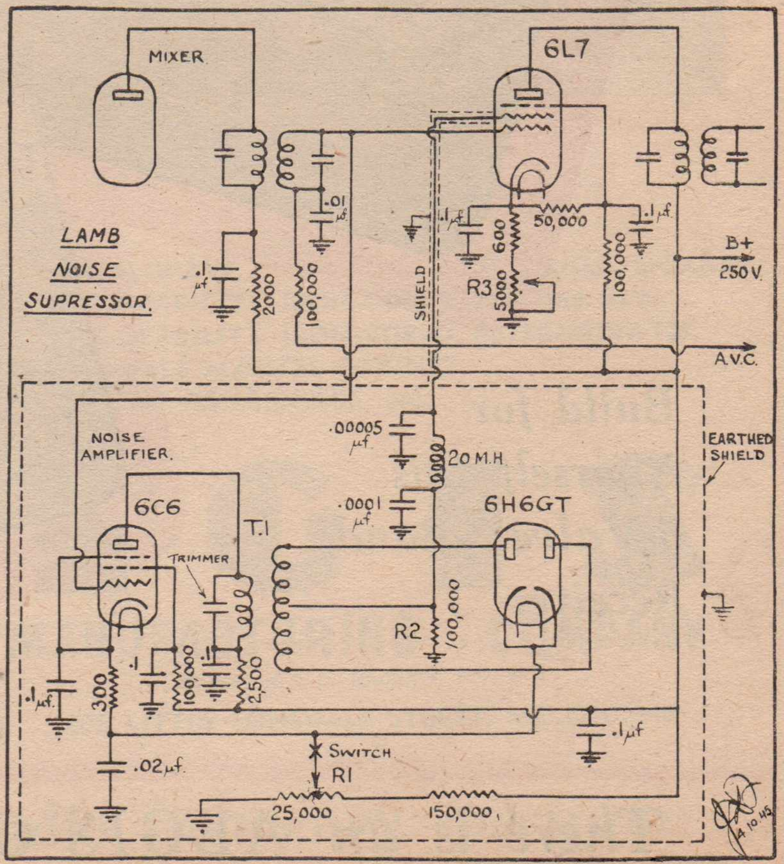
The Lamb Noise Suppressor

This unit, devised by Lamb, one time Technical Editor of the A.R.-R.L. magazine, has already been described in various radio journals. On paper it would appear to be most advantageous, but in practice it has many limitations. The unit, as a whole, functions effectively, but has the disadvantage that the "cut off" point has to be adjusted manually with the greatest of care, as otherwise severe distortion results; or, alternatively, the unit is ineffective. The main weakness of the contrivance is that it is useless in suppressing static received at a lower signal level than the desired signal to which one wishes to listen, and thus in practice an appreciable amount of noise goes through to the speaker. For general communication work the suppressor is a great asset, but it will not purify a high fidelity musical programme in a thunderstorm.

Circuit Diagram

A schematic diagram of this suppressor is shown in the text and a description of its theory is as follows. The suppressor takes the form of an intermediate frequency noise silencer in which noise pulses automatically decrease the amplification of an i.f. stage during the period in which the noise voltage is being received. As will be seen from the circuit diagram, the i.f. signal is fed through two channels. The first of these is a normal i.f. stage, with the exception that a 6L7 valve is used, incorporating two control grids. The other channel contains a normal i.f. amplifier valve, the output of which is fed into a special i.f. transformer with a centre tapped untuned secondary. The voltages developed across this secondary are rectified by a suitable full wave rectifier, such as the 6H6GT. The pulsating D.C. output from this rectifier, taken from the mid-point on the transformer secondary, is filtered by means of a large r.f. choke and suitable mica condensers. Coming from the centre tap, this voltage is negative with respect to earth, and thus prodvides a negative bias which can conveniently be applied to the auxiliary control grid of the 6L7, and used as a control voltage to suppress noise signals. The variable resistance R3 shown in the circuit diagram is used to vary the

(**Continued on next page**)



Avail

The RADIO

AEGIS "LITTLE CO
KIT ASSEMBLY (C

Radio enthusiasts! Here at last is the ide
features and all the technical help to ens
a 5-valve 2-band receiver — A.C. operat
easy-to-build kit form, carefully engineere
the very last nut and bolt! Easily unders
step by step assembly are given away wi
include pictorial and schematic diagram
where each part belongs and where every
PLUS lining procedure for the Aegis Perm
Kit and I.F.'s, type numbers K1, J1, and

Build for Yourself this 5-Valve 2-Band Receiver . . .

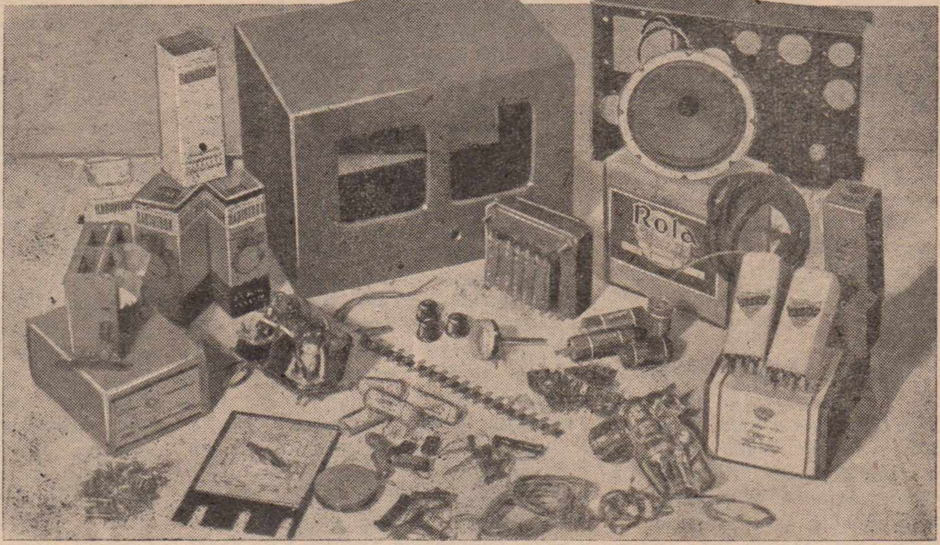
There is an AEGIS COIL *for every ap*

able at last!

KIT YOU CAN BUILD

PANION"
. No. KS5/D)

kit with all the
re succcess. It is
and supplied in
from cabinet to
od directions for
each kit. These
showing exactly
nnection is made,
bility Dual Wave



Look at these Outstanding Features:

- ★ DUAL-WAVE
- ★ ROLA SPEAKER
- ★ PERMEABILITY IRON-CORED B/C and S/W.
- ★ PERMEABILITY IRON-CORED INTERMEDIATES.
- ★ DURABLE MANTEL CABINET.
- ★ DUCON CONDENSERS, etc.

WRITE for name of your NEAREST DISTRIBUTOR

AEGIS

MANUFACTURING COMPANY

Division of J. H. MAGRATH PTY. LTD.

208 LITTLE LONSDALE STREET, MELBOURNE

plication in the radio frequency spectrum

NOISE SUPPRESSOR

(Continued)

fixed bias on both control grids of the 6L7. This potentiometer is adjusted to suit the strength of the interfering signal and keep the 6L7 at an operating point where it will "cut off" satisfactorily when static appears. With predominant static, R3 can be reduced in resistance, as sufficient bias will be received on the auxiliary control grid of the 6L7 to effect "cut off"; and with reduced fixed bias the stage will give greater amplification. However, if the static signal is small and the wanted signal smaller, the bias on the controlled tube must be increased by increasing the resistance of R3 to effect "cut off" under these conditions. Also, to help the action of the controlled 6L7 tube, it will be noted that it operates at a reduced screen-grid voltage.

The switch in the circuit is used to switch off the suppressor if desired.

Suppression of Noise Signals

This suppressor, as previously mentioned, is useful only to eliminate noise voltages which are in excess of the strength of the incoming wanted signal. The general suppression effect is illustrated in Fig. 1, where (a) shows the relative strength of static signals and the wanted signal, in initial stages of the receiver. (b) Illustrates the noise peaks in the receiver speaker resulting from static and shows that they last for a much longer duration than the actual static signal. (c) Shows how the suppressor causes minute durations of silence during the periods when the strength of the static signal exceeds that of the wanted signal. The suppressor is controlled by a potentiometer, R1, which has two functions. It varies the grid bias on the noise amplifier and at the same time controls the magnitude of positive potential on the noise rectifier cathodes. Thus, when turned to one limit, this potentiometer provides a minimum bias on the noise amplifier, and at the same time reduces the potential difference between the noise rectifier cathode and earth to zero. Under these conditions, any signal being received is amplified to the maximum extent within the limits of the noise amplifier and the highest possible potential obtainable with the circuit is developed across the resistance, R2. This voltage may be of the order of 10 to 15 volts, which is applied to the 6L7 auxiliary control grid, and which, when of this magnitude prevents it from operating. The result is that no signal passes through to the audio amplifier and no sound is heard in the speaker. Under these circumstances the suppressor is not only eliminating any troublesome interference, but is also suppressing the incoming signal. If, however, R1 is turned back a little, the gain of the noise amplifier is reduced and the cathodes of the 6H6GT become positive with respect to earth, thus reducing its ability to conduct. Under these conditions a position can be obtained with R1 such that the DC voltage developed by the wanted signal across R2 is just zero, as the peak strength of the incoming signal is equal and opposite to the voltage between the noise rectifier cathode and earth, in which case no voltage drop exists between the plate and cathode of the noise rectifier, and thus, no current passes through it. Under these circumstances, no additional bias is applied to the 6L7 auxiliary control grid and the i.f. amplifier functions normally. It will be seen, however, that if a sudden loud burst of static occurs, the increased voltage induced by it in the noise suppressor system will cause a potential difference between the cathode and plates of the noise rectifier, current will flow and thus extra bias will be applied to the 6L7, thereby limiting its amplification during the term of interference. It is on this principle that the suppressor operates, any noise signal greater in magnitude than that of the incoming signal causing the 6L7 i.f. stage to stop, or to decrease its operating efficiency during the interference pulsation. When working satisfactorily this device stops the radio receiver working completely during the period that large static voltages are being received. At first sight, this would appear almost as bad as listening to the static, but, in fact, it is a considerable improvement, as the intrruptions of silence which occur are generally not noticed by the human ear, especially in the case of atmospheric static. This is because the atmospheric interruptions appearing to last for an appreciable fraction of a second, actually take place in a time of the order of .001 sec. The reason that they appear to last much longer than this is that when introduced into the receiver normally, they set tuned circuits in oscillation and these oscillations fail to die down immediately. In addition, the duration of the noise is extended by the fact that the speaker cone and the human ear also begin to oscillate, and by reason of their inertia fail to stop immediately. If, however, these interfering voltages can be prevented before they reach the audio amplifier, the receiver will tend to carry on operating in such a manner that no silence is heard during the term of signal suppression.

From the above analysis it is clear that the efficiency of the suppressor depends mainly on the type of interference experienced. The stronger the interference signal and the smaller the duration of each noise pulse, the more effective will its operation be.

From the writer's experience with the suppressor, it can be safely said that it is most effective in eliminating interference from local thunderstorms and from sudden electrical discharges caused by the making and breaking of electric light switches. The writer has read that this unit is most effective for reducing interference caused by automobile ignition, which is noticed particularrly on the higher frequencies. Experience in this connection is, however, to the contrary. It has been found that motor ignition is generally received with about the same punch, or less, than that of the transmitter signal and, of course, when this is the case, the noise suppressor is useless as, if it is adjusted to partially eliminate the static, it also reduces the transmitter signal as well as distorting it. It has also been found that motor ignition interference is rather of too continuous and rapid a nature to be dealt with properly by the Lamb suppressor. Interference from vacuum cleaners, refrigerators, and electric motors in general is also difficult to cope with effectively, owing to the relatively long duration of each cycle of interference generally caused by the inductive lagging of interrupted currents.

The difficulties experienced with the Lamb suppressor in dealing with noises of long duration may be heard with interest if the device is used to cut out a strong morse signal on the same frequency as a W.T. transmitter. As far as suppression is concerned, the unit is very effective, but owing to the relatively long time that the key makes contact, the receiver is stopped working for relatively long pulses, particularly during dashes, and generally these interruptions of silence render the W.T. signal unreadable.

Frequency of Incoming Signal

A point which cannot be overemphasised is that when receiving short waves, the suppressor becomes less and less effective as the frequency of the incoming signal increases. It is the writer's experience that the unit is not much use for the elimination of static on wavelengths below 25 metres, if the suppressor controls the i.f. valve adjacent to the mixer in a superhet. This is only to be expected as, on the higher frequencies, it becomes difficult to obtain high enough amplification in the r.f. and mixer stages to drive the suppressor effectively, as the latter must supply a negative voltage of the order of 7 volts to the i.f. 6L7 before it becomes effective. However, at practically all frequencies the suppressor influences unwanted loud noises to some useful extent, even though it may not completely eliminate them. This difficulty on higher incoming frequencies can be overcome to some extent by using an i.f. amplifier ahead of the controlled 6L7 stage, but it is preferable that the suppressor should control the first i.f. stage in the receiver before high selectivity circuits are reached.

The only method of overcoming this high frequency trouble is to increase the radio frequency amplification before the mixer tube. The writer's set has two r.f. stages, which provide sufficient amplification to enable the suppressor to work satisfactorily on the 16 metre band. With one r.f. stage only, however, insufficient drive is available to work the suppressor satisfacorily, except in cases where a distant signal is being blocked by strong local static. With one r.f. stage, the suppressor is quite effective on and above the 25 metre band. One method of increasing the gain ahead of the converter is to apply regeneration to the r.f. stage, thereby increasing its amplification. This method is not very satisfactory in practice, however, as whenever the regeneration control is altered, the tuning is thrown out of alignment and the set thus has to be retuned for maximum r.f. amplification. However, if this defect is tolerated, the additional amplification gained is very handy in increasing the strength of weak signals and in decreasing the relative strength of "shot effect" noises in the converter valve. However, grid noises are increased and the overall result is that the equivalent noise voltage remains practically the same.

Generally speaking, for short wave reception it is not worthwhile fitting a Lamb noise suppressor to a superhetrodyne without an r.f. stage. For really effective results two r.f. stages with high "Q" coils are necessary.

Should any reader anticipate building a Lamb noise suppressor, it is well worth the trouble and provides an interesting piece of experimental work, but don't be disappointed if the results are not all you expect. Values of all components are shown on the diagram. A few words on the construction of this unit will not be out of place, as it is tricky to construct satisfactorily.

Construction of Suppressor

First of all, the 6L7 and 6H6GT valves required may be difficult to procure. The non-microphonic 1612 may be used in place of the 6L7, if necessary. As both cathodes of the 6H6GT are tied together in this circuit, no trouble should be experienced if this valve is replaced by any duplex diode triode or duplex diode pentode such as the 55, 2A6, 2B7, 6SQ7, etc. In this case, only the cathode and two diodes would be used in the circuit, the other electrodes being disconnected. A 6J7G may be used in lieu of the 6C6 if more convenient.

It is unlikely that the centre tapped i.f. transformer T1 will be found in any shop and the best thing to do is to set about and wind it yourself. This is not an easy task with limited equipment, but can be achieved. A transformer of the intermediate frequency to suit the receiver should be obtained and one coil should be unwound and replaced by two similar coils of about the same number of turns, one wound on each side of the primary and spaced closely to it. The two new coils have the same number of turns, have the same dimensions and must be equally spaced on each side of the primary. When the noise suppressor is completed, the primary of the transformer may be lined up by the

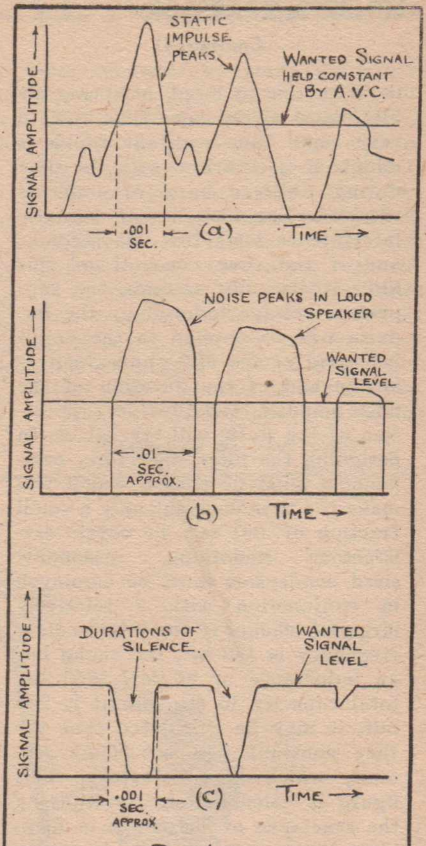


Fig. 1

usual method of using an oscillator and by ajusting the primary tuning condenser until a maximum voltage is shown across R2 on a vacuum tube voltmeter. Alternatively, the condenser can be adjusted until a maximum current flows through the R2 circuit, this being measured with a DC milliamp meter. If an oscillator is not available, fairly good adjustment may be made by simply turning the receiver to a steady signal and adjusting the tuning condenser of T1 until maximum output voltage is apparent.

The most difficult component to obtain is the r.f. choke. This again has to be home made, as it has a relatively large inductance of 20 mH. The ordinary r.f. chokes available on the market are not suitable, as their inductance is only of the order of 1 or 2 mH. This choke and the two condensers associated with it are most important in connection with the efficiency of the unit. Firstly, it is essential that the filter made by them will efficiently smooth out the pulsating DC voltage applied to

(Continued on next page)

NOISE SUPPRESSOR

(Continued)

it. With this in mind, however, the filter must at the same time, have a very small time constant which is minute in comparison with the time during which a burst of static is received. For instance, if a static interference lasts for .001 seconds, and if the time constant of this filter is also .001 seconds, the suppressor voltage induced by the impulse will be applied to the auxiliary grid of the 6L7 approximately at the end of the duration of the noise impulse, and thus no suppression of the static will take place. In designing the filter, therefore, components must be chosen which will make the time constant only a small fraction of .001 sec. To obtain satisfactory smoothing, reasonable sized condensers must be employed in conjunction with a relatively large r.f. choke. If the intermediate frequency is 460 kc., the choke has an inductance of 20 mH, and the total capacity in the circuit is 200 uuf, it may be calculated that the time constant will be .00001 seconds, which is satisfactory. This figure is calculated by multiplying the reactance of the choke in megohms by the total capacity in microfarads.

Automatic Volume Control

On short wave work particularly, it is necessary that automatic volume control be employed in any receiver fitted with a Lamb suppressor, and that plenty of A.V.C. be applied to the initial stages of the receiver, ahead of the suppressor. The lower the time constant of the A.V.C. circuit the better. The A.V.C. keeps the strength of the wanted carrier at a fairly constant level when fading signals are being received, and thus enables the suppressor "cut off" control to be set at a position where it will limit static signals of slightly greater magnitude than the A.V.C. controlled signal level.

If A.V.C. is not employed, the suppressor "cut off" control must be set at a position where it will not limit static signals of slightly greater magnitude than the A.V.C. controlled signal level.

If A.V.C. is not employed, the suppressor "cut off" control must be set at a position where it will not limit the wanted fading signal when at its maximum intensity. Under these conditions, the ratio of unwanted signal increases considerably when the fading wanted signal is at its weakest strength.

It is worth noting at this juncture that the reason why an ordinary A.V.C. system will not reduce static is because the time constant of the A.V.C. filter is much larger than the time duration of a static impulse. Also with A.V.C., part of the static impulse will reach the audio amplifier before the control voltage is applied, even if the time constant is kept small.

Making the Choke

It is recommended that anyone anticipating building a choke of this size should make reference to the Radiotron Designer's Handbook, or the Admiralty Handbook of Wireless Telegraphy, where the design is completely covered. It is necessary to wind the choke in 5 or 6 separate layers separated from each other by at least 1/8-in. to minimise inherent capacity. The core can be made from a piece of curtain rod or bakelite tube, of say, ¼-in. diameter. Before use, the rod should be boiled in pure paraffin wax to drive out any moisture, as this will cause eddy current losses within the choke. The condensers used in the filter should be of the best type with mica insulation.

Finally, a word about shielding. Complete shielding of the suppressor unit, as shown in Fig. 1., is essential for efficient operation. With improper shielding instability may occur. The worst effect from insufficient shielding occurs when signals from the suppressor unit are picked up by an i.f. stage, following the suppressor system. In this case, the suppressor acts in all as an amplifier, as although it still limits the action of the 6L7, it passes on a strong enough signal by radiation to the rest of the receiver, to spoil all the suppression effects. The only way over these troubles is to completely shield the unit.

Use With Short Wave Converter

Should a L.N.S. be built in conjunction with a short wave converter, it is essential that the lead connecting the converter to the broadcast receiver be very short. This is necessary because when the receiver is working flat out, as it generally is for the reception of short waves, quite an amount of static is picked up on the connecting lead at broadcast band frequency and this statis is not suppressed.

Use With Existing Superhetrodyne

If it is desired to incorporate the suppressor in an existing set, this can easily be accomplished by building up the suppressor as a separate completely screened unit. The ate completely screened unit. The first, or second i.f. amplifier in the set should be replaced by a 6L7 and its subsidiary resistors and condensers as shown in the text. Great care must be taken that all leads carrying i.f. or control voltages between the suppressor and the set are completely screened.

BATTERIES FOR BABY PORTABLES

Enthusiasts will be interested in some details of the new batteries designed for portable radio receivers, which will be available soon.

The "Eveready" No. 745 battery is a 1½ volt "A" battery and contains the same size cells as the pre-war "Eveready" No. 741 battery. However, in order to provide a better layout for the grouping of the "A" and "B" batteries, the eight cells have been arranged in a single row instead of two rows of four. This is not a "Mini-Max" battery, as the "Mini-Max" type of construction is only used where a number of small cells are connected in series, but is intended for use as the "A" battery when two "Eveready Mini-Max" No. 482 batteries are used for the "B" supply.

The "Eveready" No. 745 battery measures 3-7/8in. long by 1-7/16in. wide by 10 25/32in. high and weighs 2lb. 13oz. It is fitted with a two-pin socket for connections.

The "Eveready Mini-Max" No. 482 is a 45-volt battery intended to take the place of the pre-war "Eveready" No. 762 battery in new equipment. This battery will give equal or slightly more service than the No. 762 although it is only half

(Continued on page 25)

EMPLOYMENT IN THE RADIO TRADE

THE Daily Press has given many "boosts" to the prospects of tremendous expansion in the radio industry after the war, and has stated that there will be profitable employment for tremendous numbers of men. It is true that domestic broadcast receivers will be wanted in large numbers to replace those that have become obsolete, or even worn out, during the years when replacements were not obtainable. Similarly, one may expect that civilian air lines will be consumers of fairly large quantities of radio and radar equipments.

But with all this work in prodspect it would be unwise to assume that the radio industry can give full employment to all those men who are now concerned with radio in the Forces, in research establishments and in the factories producing radio equipment for war needs. There are probably many thousands in the three arms of the Service who have been engaged on radio work during the war, and who have come to believe that work of a corresponding nature will be much more pleasant — and far more lucrative — than was the job in which they were employed before 1939. Many with suct ideas are sure to receive a nasty shock if they are not given due warning before it is too late.

Suitable Qualifications

The men who will be best qualified to take the better radio posts in the post-war industry are those who had a wide experience in prewar days, followed by further experience gained either in the Services or in factories or design establishments working in collaboration with the Services. Only in exceptional cases will the bank clerks, local government officers, school teachers and the like of pre-war days find it profitable to change their jobs by making radio their career. The few-weeks' or few-months' courses in radio given to those joining the Forces, although excellent in themselves and sufficient for their purpose, do not qualify a man as a radio engineer.

These remarks apply principally, of course, to those who did not take any particular interest in radio before the war; those who spent a good deal of time in amateur radio activities are in a different category entirely, and many of them are now quite as competent as men who have spent a lifetime in the industry.

Pre-war Salaries

If one is to take a realistic view of the possibilities it is wise to consider the conditions which obtained in the wireless industry in "other days." In most cases, rates of pay were extremely poor. This applies not only to factory employees and charge hands, but also to technicians and designers. As an example, it can be stated that £300 a year was regarded by many manufacturers as a good salary for technicians with first-class degrees employed on the design, test and inspection staffs. Similarly many "outside" service mechanics were lucky to get more than £3 a week. Those employed as factory hands (on hourly rates!) were often "sacked" at a few hours' notice. Many could find a new job in another factory quite easily, but they may find that they had again to seek a new job after a few months, or even weeks.

Another important point which

(Continued on next page)

EMPLOYMENT

(Continued)

should be remembered in connect with set manufacture is that the industry has always employed a large proportion of female labour. There is no reason to suppose that this order will be changed, because women and girls arte often found to be more adaptable to mass-production work which calls for unlimited patience and permits little scope for individual ingenuity.

Managers Wanted

There were, of course, and always will be posts worth upward of £1,000 a year, but these are few between. The difficulty is always to fill these posts. To earn such salaries in the radio industry a man must have sound organising ability, bright (and workable) ideas, knowledge of production methods and manufacturing processes, a "sixth sense" of the public's needs, or really sound ability as a radio engineer. The odd man who combines all of these qualifications may well make a fortune if he also has business acumen and is a conscientious worker. One with any two of the qualifications should be successful if he is able to prove the fact to a prospective employer.

In the technical field there will undoubtedly be very keen competition in post-war years, partly because hundreds of young men have studied radio seriously either during their training period of graduation at a university, or immediately after graduating. Anyone who proposes to enter this field would therefore be well advised to obtain whatever qualifications he can.

The Future of Radar

Having seen some of the difficulties in the path of the would-be radio worker, one might well consider the general types of job which will be available. Perhaps the most promisingw ill be those in connection with television and with radar equipment. In many respects the techniques of television and radar are closely allied, because in both cases one is concerned with the transmission and reception of pulses, whilst ultra-short waves are employed for both. But whereas television will be employed very largely for domestic entertainment, radar will have more application in the commercial field. For example, radar devices will undoubtedly be as common on post-war ships as was a fog horn in 1939. They will also be used in all aircraft, and they may eventually find an application in railway trains and road vehicles. The scope is extremely wide both in the realms of research and manufacture.

—"Practical Wireless," England.

F.M. STATIONS IN U.S.A.

There are now 46 frequency-modulation stations on the air in the United States, and it is reported that more than 300 are planned for after the war. About five hundred thousand F.M. receivers were sold before production was halted by the war.

HAMMOND ORGAN

(Continued)

is connected a filter comprising a .01 mfd. condenser in series with a 10,000 ohm resistance. This network is to provide a filter for suppressing the key clicks. Shunting the secondary also is a 100,000 ohm volume control which is attached to the swell pedal, by means of which the volume of the instrument may be varied within wide limits. The selector bars shown in the diagram provide a means of switching the output of any given combination of notes played, across a greater or lesser number of turns of the primary and in this way by having the relationship of the fundamental to the various harmonics variable and vice versa, an amazing number of tonal qualities may be produced.

Although shown in the diagram as a potentiometer, the control in later models has been replaced by an attenuator, which is attached to the swell pedal for the purpose of varying the output of the organ; here again the Hammond scores over the pipe organ insomuch as the degree of softness and loudness is much greater than the conventional organ: in other words, the dynamic range is greater. If necessary the Hammond could be used with a 100 watt amplifier should the required coverage area be big enough; naturally more speakers would be needed to handle such a large output. Before leaving the output circuit it may be necessary to touch on the "tremolo" mechanism.

Mounted upon the rotor shaft of the synchronous motor is an eccentric member which is so geared that it makes and breaks a pair of contacts connected across secondary of the output transformer 5 times per second. The associated values of this circuit are .002 mf condenser, 10,000 ohm variable resistance and a 2 meg ohm fixed resistance which shunts the contacts. The degree of "tremolo" is regulated by the variable resistance, and is more noticeable in tones of high frequency than tones in the low frequency register. The 2 meg shunt resistor serves to prevent key contact noise getting through to the amplifier.

Understanding the Charts

A careful study of the accompanying charts will enable most amateur radio enthusiasts to grasp the operational principle of the Hammond far easier than pages of writing.

In column one are the various notes, column two gives the reference number of each tone generator from one to eighty-nine, column three gives the number of points on the various rotating tone wheels, columns four to seven give the gear ratios required to accurately produce the correct musical tones. Columns eight and nine refer to the actual frequency produced and the theoretical musical tone or frequency in the tempered musical scale known as standard low pitch, which is governed by the note A^3 on the tempered scale, being equal to 440 cycles per second. At this point on the chart it will be noticed that the frequency of tone wheel number 46 is exactly equal to the tempered musical scale frequency. The octaves above and below A 440 are similarly equal to the corresponding tempered musical frequency. At other frequencies, however, it will be seen that there are slight differences between the generated tone and the tempered scale note. This is due to inherent limitations in mechanical gearing in obtaining fractional ratios. However, the inaccuracy is so small that it may be safely neglected, in fact quite often, musicians, if they may be termed such, play as much as a quarter tone off key, without being aware of it, and seeing that error in the Hammond is worked out in terms of frequency to three decimal places, it is extremely unlikely that the human ear could detect the frequency error.

The remaining columns in the chart indicate the second, third, fourth, and up to the seventh harmonic or partial. The later models used an extra two sub-harmonics, i.e., below the fundamental which makes number of tone colours available greater still. Having covered most general points about the Hammond, it is proposed to jot down a few items of interest for those such as V.D., of Bondi, who recently wanted information on the per-mags and the tone wheels on the Hammond. N.B.—all care, but no responsibility taken.

(1) Shape of teeth is not critical, so long as the gap length is of the order of ¼ to ½ tooth pitch, which will allow appreciable fanning out of flux between teeth as tooth space passes under the tip of the magnet. Usually ordinary "involute" shape should suffice, i.e., down to 8 tooth type.

(2) The two and four "tooth" wheels are not really "toothed" at all, but can be made either out of ordinary square stock for the 4 "tooth" and rectangular stock for the 2 "tooth", or to follow the Hammond principle correctly, they would have to be radial sinoids worked out to the formula r=ro (1+a Sin O)
ay
ro and a constant. Since e=N—,
at
e is sinoid of Oy, is sinoid or "cosinoid." All of which means they are somewhat circular in shape, but have very slight undulations around the periphery of the tone wheel, which give the required number of points on the lower register.

Pick-up Coil Data

As explained previously, the impedance of the pick-up coils must remain at a constant 4 ohm impedance at all frequencies, consequently the turns of the coils will vary and

BATTERIES

(Continued from page 22)

the physical size. This is made possible by the exclusive "Mini-Max" construction which makes maximum use of the available space. This battery measures 3-13/16in. long by 1-27/32in. wide by 5½in. high and weighs 1lb. 4oz. It is fitted with a three-pin socket for connections.

The new battery complement for portable receivers has been designed so that, if desired, the two "B" batteries may be stacked end-to-end on top of the "A" battery to give a rectangular over-all shape with a minimum of waste space. This allows the receiver cabinet to be little more than four inches wide and of a shape that makes for easy carrying.

Both the No. 745 and No. 482 batteries will be released about the end of March and plugs for these batteries will also be available at that time.

The "Eveready Mini-Max" No. 467 is a 67½ volt battery designed primarily for use in "personal" portables. It is used i nconjunction with "Eveready" No. 950 flashlight cells, either singly or in parallel, for the "A" supply. The miniature 1.4 volt valves will be available here within the next few months and a number

(Continued on page 34)

HAMMOND ORGAN

(Continued)

are given here in approximation.

FREQ.—	32	64	128	256	512	1024	2048	4096	7744
TURNS—	830	620	460	343	256	191	142	106	82

For inbetween values a curve should be drawn on graph paper and intermediate turns got by interpolation.

Core material ¼-in. hardened silver steel rod. Wire gauge ranges from 26 to 32 s.w.g. enamel. (26 gauge used on low frequency coils.)

The tone wheels are made up of ordinary mild steel of 1/8-in. to 3/32-in.

The driving gears should preferably be made of fibre or some such composition and the couplings between the driving gears and the tone wheels should be flexible.

The diameter of the tone wheels is not critical and approximates around 2-in. to 1¾-in. However, all this is beside the point; this article was never intended as a constructional one on how to build a Hammond organ, but was merely intended to be descriptive.

The mechanical difficulties to be surmounted in an instrument of this kind, particularly by the home constructor are practically insuperable, and the writer strongly advises anybody contemplating such a project to step very warily indeed. One needs exceptional ability, both in mechanical, musical and the radio field before even starting a job of this nature. For the past nine months the writer has been engaged in developing something entirely original in this direction, and completely electronic in operation, which in spite of numerous difficulties, is proving very satisfactory and a much easier solution to the radio enthusiast in this particular field, than trying to emulate the Hammond. The writer, without making rash promises, hopes that in a further six months to be able to give a general description of his experiments in connection with the above instrument. The scheme is so radically different from anything yet seen that if it should turn out as expected the writer proposes taking out a patent, after which he hopes to turn the whole box and dice over to those R.W. readers who are interested.

In conclusion, the writer would like to apologise to several readers in the past who have written re electronic music problems, probably not realising that writing is only part of my work, and that under the present circumstances, answering correspondents is out of the question, due to the amount of drawing and written matter involved.

Those desirous of further information re the Hammond organ are advised to contact the Patent Office in your own particular State. On a payment of 1/6 , and asking for the complete specification on Patent No. 20,982/35, Class 01.7, you can get enough information therein to build a Hammond if you so desire. Before doing so examine your bank balance and determine whether it will stretch to £400 or £500; if it won't, then go to the nearest junk shop and buy a harmonium, and pedal away, with your intact bank balance safe in your pocket.

CALLING CQ!

By DON KNOCK

ONE ironical thought for "ten metre" DX men is the seasonal European QSO's that would be nightly affairs at this time of the year—if the ban didn't exist! Judging by the overpowering B.B.C. sig. strength around 21 Mc/s at 8 p.m., E.A.T., the G's would be a certainty on 28 Mc/s. This I suggest for sound reasons:—

1. Reference to my log book of pre-war days reveals that in 1935 we were, from Eastern VK, working G's on "ten" between 6 and 9 p.m. during the months of October to December.

2. The eleven year sun spot cycle theory says that a repetition of these conditions is about due.

Pipe dreams, of course, but where there's smoke there's fire! A little "squegger bird" whispered in my ear that in service circles a big stick is being wielded against future VK frequency allocations. Certain gold, red and blue braided people have decreed just where VK's shall go, and "squegger" chirrups that benevolence is not in the picture. Somebody should tell these temporary arbiters of "ham" destiny about the war job the VK has done. The story goes that the order of things may be V-H-F's and "ten metres," but that the frequency Rajahs won't hand over the H.F. bands. It **can** happen here, but probably not in U.S.A., where the Government and F.C.C. exhibit a generous gratitude for amateur services rendered.

Dial Twisting

If the "ham" is not experimentally inclined or filled with a liking for constructing his own gear, he is apt to be more of the DX QSL type, and thereby a slave to the receiver dials. Everybody to his own liking, and the fact that a "ham" lives in an individual world of DX contest, QSL card hunts and such like is all to the good. Other people derive a lot of pleasure in evolving the gear he may use, and quite a lot of gadgets can go to make up a crackerjack DX station. Of receivers—"if you don't hear 'em, you can't work 'em"—is true enough, and I consider that first requisite is a smoothly functioning and sensitive receiver. **That** doesn't signify that a "super-dooper" multi-valved affair is **imperative** because the old hand at this game knows that the lad with a neat little "blooper-dooper" (det. and audio) is likely to snag just as much DX as brother moneybags. Seriously though—the modern communications receiver is a sheer pleasure to use, which reminds me—I heard a soul-shaking story of petrol being poured over HF200's, SX28's and the like, and then ignited, up in "the islands," so that they wouldn't be a glut on "the market." To do such a thing to beautifully-turned out equipment, the product of leading world manufacturers is, to a radio-man of 34 years' experience, sheer criminality. Worst of it is—the report is from a source so reliable that I don't doubt it to be correct. Those directly (and indirectly) responsible should be haunted by ghosts of massacred Hallicrafters and Hammarlunds! In between building up things in wistful preparation for the "big day," the envious "ham" can twist a few dials on his RX and note what's going on around the Pacific. The "ole twanny meter" band is just now choc-a-bloc with W's in occupied territories—and some not occupied. To list them here would be like an SWL report on SWBC stations.

Heaven knows, some of the facsimile and teleprinter stations

PANORAMIC RECEPTION

A most interesting lecture was delivered before the W.I.A. in Sydney recently by Mr. G. Parker, B.Sc., B.E. (VK2AHO), of Radio Physics Lab. The subject was one which has been touched upon in overseas publications of late, but because of the handicaps of war, has not yet had practical application among amateurs. "Panoramic reception" is just what the title implies; it portrays on the screen of a C.R. tube a wide band of frequencies extending either side of a "reference" or centre point. The idea has obvious attractions for the versatile "Ham" and also the radio trade.

If, for example, a channel inside an amateur DX band, of 100 kc/s or more is observable on the screen, the clear spots free (temporarily) from QRM are indicated, and a VFO controlled transmitter can be tuned to that position quickly. The ability to do this may, however, have its limitations, if hundreds of "panoramic" equipped stations in quest of a clear spot, all pick on the one position at the same time. An example of panoramic reception applied to war is that special "interference" transmitters may blot out enemy transmissions by observing his communication channels on the screen, and shifting FM-type high-powered signals on to his frequencies.

The battle of Tunisia was stated to have been won by the Allies because Rommel's tank communications were thus "taken care of" by panoramic observations, our own armoured vehicles were kept in "the clear" for frequencies whilst the enemy's were jammed. Although an "adaptor" can be built to tie in with an existing conventional superhet. receiver, it is a somewhat complicated gadget. No doubt a simpler form will be evolved in due course. One obvious application is for visual adjustment of a transmitter frequency against a standard frequency such as a harmonic from a 100 kc/s oscillator.

—D. B. Knock.

HAM NOTES

(Continued)

around 14 Mc/s must be running into quite a lot of QRM from C.W. and phone. I don't suppose the "gang" who create the QRM are much concerned about it either. One gets the impression that, after all, "this is a 'ham' band, if you don't like it—get out." Already the band sounds much like pre-war days, and what the real QRM will be like when the lid comes off in U.S.A. is something else. I overheard a W9 (in Okinawa) say that W's return to the air in U.S.A. on November 15th.

Mixed up with these "occupational" "ham" stations are a few erstwhile VK's. One, a VK3 who says he is in Lae, N.G., puts down a powerful phone sig, and so he should, if he is using an Army 133 outfit with all of 300 watts "up the spout."

Choice of the listening gear at the writer's "shack" alternates (for HF's) between a Philips R163 and a 6-valve home-grown "ham" band RX. The latter is within the scope of the average constructor—is unpretentious, band-spreads over 80, 40, 20 and 10 m, has one I.F. at 1600 kc/s and premixer R.F. selection. It is designed solely for the "ham" bands. The former is a useful example of a very sensibly-designed general coverage communications receiver. It takes in everything from 550 kc/s to 22 Mc/s in three bands, has B.F.O. for C.W., panel midget speaker with muting switch, where headphones are desired, and sports quite a "Hallicrafter" appearance. This receiver is filled with high-quality components, for it is a junior version of the Philips Reception Set No. 4 made to Australian Army requirements and thus to rigid specs. As this job takes in 21 Mc/s, it serves admirably for use with a V-H-F converter using 955 mixer and oscillator with EF50 I.F. stage at 21 Mc/s for coverage of 140 to 80 Mc/s. Friend VK2AFB (Frank Dickson) put a converter of this ilk into my hands for a test, and conclusions are that it is an excellent answer to the V-H-F "ham's" needs.

W.I.A. (N.S.W.) Doings)

Weighty problems have confronted N.S.W. Council of W.I.A. of late, main bones of contention being post-war proposals for the P.M.G. to chew on, and the very important business of inaugurating A.O.C.P. classes. N.S.W. Division plans to acquire permanent rooms for H.Q. but Sydney City has nothing to offer at this stage. Nevertheless, the training of aspirants for A.O.C.P. is of paramount importance and, starting in December, probably at the Y.M.C.A., Elgar Treharne (VK2AFQ) will run classes two nights weekly. Syllabus will take in essential theory and code at 12 W.P.M. In recognition of duties performed, including the at-times discouraging job of keeping W.I.A. together during war, Wal Ryan (VK2TI), chairman, N.S.W. Div., was voted on 25th October by Council as a life member.

All N.S.W. "hams" and interstate men, also VL's and XYL's who may be in or near Sydney on 22nd December next, note:—

W.I.A. (N.S.W. Div.) Annual Dinner

With the end of the war, and with the growing momentum of renewed interest in Amateur Radio, the first post-war annual dinner is to be held at the Dungowan Restaurant, Martin Place, at 8 p.m. on Saturday, 22nd December, 1945. A full attendance is expected and those planning to be there should drop a line to Hon. Sec., W.I.A., N.S.W. Div., Box 1734JJ, G.P.O., Sydney.

Meanwhile, we hope that the occasion may turn out to be one of celebration of removal of the now irksome ban on amateur transmission.

Amateur Chatter

There's a logical move on the part of the W.I.A. to see that the Ham gets a fair deal re the auctioning of exservice radio gear Ex Disopsals Commission. The Government seems to have played right into the hands of dealers, some of questionable repute, who buy large lots wholesale and then retail them later at extor-

(Continued on page 34)

PERTINENT PONDERINGS—By D.B.K.

Pertinent Ponderings

We can't help applauding the action of the crowd of "W's," etc., around Luzon, Mindanao, Okinawa, Saipan, Tokio Bay, etc., in taking the bull by the horns and "taking over" on 14 Mc/s. Somebody had to start it or maybe officialdom might have assumed that the "ham" was apathetic about the future. No doubt the O.'s C. the Allied Sig. Units concerned are "hams" themselves.

* * *

Rumors that VK's are not likely to get "80," "40" or "20" back indefinitely are current. "These freqs. are needed for service channels." Sounds like it, judging by the tripe that goes on for hours (per C.W.) between two service stations around 7050 kc/s. Fred and Jim had a long yarn about a "lovely" they both knew in Hamilton t'other night. Oft-times ACW's can be heard op-chatting with male OP's at the other end. Service requirements my eye!

* * *

If and when 7,000 to 7,300 kc/s is returned to the "ham," it will certainly need an International Conference to get the B.B.C. and Shepparton out of the band. We recall an editorial in QST saying something about "we'll mow them down, and blast them off." O.K. for California Kilowatts!

* * *

Funny, isn't it, but the one nation that's been at war solidly for years—even with civil war—has permitted amateurs to carry on ad lib. China has her XU's and they can often be heard on 20 m. phone.

* * *

That lad "W6ZZZ" who says he is "afloat off the coast of Okinawa, and using 700 watts," certainly sounds like it. A "California Kilowatt" keeping his hand in?

I notice that very few of these "occupation 'hams'" are using service phonetics. "Roger," "Wilco," etc., seem to be tabu, and the good old "ham" lingo is being aired again.

* * *

Does that R.A.A.F. station with the multiple TX calls on 3.1 Mc/s ever handle traffic or does it just bat out "VVV" in a "V for victory" spirit? Reminds me of 1926-28 when a commercial "top end of band marker" for 40 was WIZ—who sent incessantly ABC, ABC, ABS, de WIZ. It was a little boring after hearing it for years.

Honour Roll

The following advertisers gave their support right through the war years. Although they had no need to do so, they advertised in the "Australasian Radio World" to enable it to continue publication, and thereby maintain interest in technical radio. Every reader owes these firms a debt of gratitude.

LOYAL ADVERTISERS

AUSTRALASIAN RADIO COLLEGE
—offering you a sound training in practical radio and theory.

GEORGE BROWN & CO. PTY. LTD.
—Australian concessionaires for "Ultimate" receivers, which have outstanding performance on short-waves, as well as everything you desire on broadcast.

CLYDE BATTERIES PTY. LTD.
—manufacturers of the finest radio accumulators and car batteries.

CROWN RADIO PRODUCTS PTY. LTD.
—radio components of reliability and precision.

EITEL-McCULLOUGH INCORPORATED, U.S.A.
—makers of the most efficient radio transmitting valves for amateur and commercial use.

KINGSLEY RADIO PTY. LTD.
—manufacturers of highly-efficient "Permaclad" coils and intermediates.

J. M. McGRATH PTY. LTD.
—Melbourne's leading radio parts wholesaler and sponsor of "Aegis" components.

W. J. McLELLAN & CO.
—Sole Australian agents for the reliable "I.R.C." resistors.

MULLARD, AUSTRALIA, PTY LTD.
—Australian distributors of those fine "Mullard" radio valves.

RADIOKES PTY. LTD.
—Builders of reliable coils and radio components.

R.C.S. RADIO PTY. LTD.
—makers of precision-built radio components, featuring "Trolitul" insulation.

ROLA CO. (AUST.) PTY. LTD.
—offering the world's best loud speakers.

STANDARD TELEPHONES & CABLES LTD.
—manufacturers of the British "Brimar" valves.

TECHNICAL BOOK & MAGAZINE CO.
—foremost in Australia for technical books and publications.

TRIMAX TRANSFORMERS
—makers of high-grade audio and power transformers.

"AUSTRALASIAN RADIO WORLD" joins with its readers in offering a hearty vote of thanks to the above advertisers for their loyal support through the troublesome war-time period.

A. G. HULL.

Shortwave Review

CONDUCTED BY
L. J. KEAST

NOTES FROM MY DIARY

Walkie-Talkies

In September issue I referred to this new type of transmitter-receiver. Further advice is to hand from the U.S. Information Service. The Federal Communications Commissioner said on 15th November that about 25,000 lightweight two-way radiotelephone "walkie-talkie" sets will be in use by about next June. Prices may range from 50-150 dollars (approx. £15/6/- to £46) per set. The Federal Communications Commission will announce rules and licensing procedure for "walkie-talkie" users within two or three months. It is expected doctors, farmers, sportsmen, explorers and organisations such as department stores, dairies and laundries would make early use of war-developed gadget. Set weights range from three pounds for light apparatus to much heavier equipment for use in autos and rooftops. Range is from one to fifteen miles, depending on terrain.

No further mention is made of frequency to be used, but it was said some time ago that 460-470 megacycles had been set aside for this type of transmitter.

Parallels

The following stations now take the same programme from 'Frisco between 7 p.m. and 12.45 a.m.: KNBA, 7.56mc; KCBA, 7.57mc; KCBF, 9.75mc; and KRHO, 6.12 mc.

Programme is intended for Japan, Korea and South-east Asia and after 5 minutes of news in English at 7 p.m., mostly in Japanese and Korean till 11 p.m., when another 5 minutes of news in English is heard. From 11.05 till midnight Thai is used when another 5 minutes of news is given. At 12.05 a.m. on Monday, Thursday, Friday, Saturday and Sunday, news in French, whilst on Tuesdays and Wednesdays at this time musical gems are played.. At 12.15 on Monday, Thursday, Friday, Saturday and Sunday, news in Annamese, but on Tuesday "Uncle Sam Presents" and on Wednesday Musicale Americana. From then on till closing, all English.

More Parallels

KCBR, 15.27mc, and KRHO, 17.80mc, from 7-8 a.m. in Japanese with exception of news in English at 7 a.m. From 8 a.m. KCBR until 1 p.m. is in English, Korean, Tagalog and Thai till 11 a.m., when till closing is in English.

And Still More Parallels

KNBX, 7.80mc, KCBR, 9.70mc, and KGEX, 7.25mc, are together from 8 p.m. till 12.30 a.m. They are joined by KWID, 7.23mc, from 9.45, who remains with KNBX and KCBR till 2a.m., KGEX having retired at 12.30. The above broadcasts are for the Philippines, China and Indonesia, the languages being English, Tagalog, Mandarin and Cantonese.

In the mornings directed to the same area, KNBX, on 15.24mc, opens the day at 9 o'clock with 10 minutes' news in English and from 9.10 till 9.45 is joined by KRHO, 17.80mc. At 10 o'clock KRHO drops out and KGEX, 15.21mc, comes into line with KNBX till 11.45, and from 11.45 till noon, while KNBX is changing frequency is on his own. At noon KNBX is alone 1 p.m. on 15.15 mc.

Verifications

Most Dx-ers are perfectly content to log as many towns as they can; others prefer to make countries their goal, whilst others out of a deep appreciation for the fine programmes heard, send report after report, although a verification may have been received. This continued mailing of reception data invariably brings rewards and probably nobody knows this better than Arthur Cushen. He was one of the first to receive a pair of Dutch clogs from the Philips station in Hilversum, Holland. Then a motor car plate from COK, Havana; now he quite proudly notifies the arrival of a very fine leather wallet made by an Andes Indian. As if that was not sufficient for his numerous reports over many years, HCJB, Quito, Ecuador, also threw in for good measure a pocket atlas to acknowledge the correct logging of their new 19-metre band frequency, 15.09 mc. Well, I'm just wondering what use the wallet will be to Arthur, unless for safe keeping of his motor licence or petrol ration tickets. He is to be married in February, but maybe the atlas will remind him of the boys over the Tasman that he used to write to when he could please himself what he did.

SAYS WHO?

Read the other day where PH12, Huizen, 17.77mc, 16.88m, had been heard testing around 10.30 p.m. Signal was said to be weak. I heard somebody around that spot, but noise and morse were very prevalent. I think this is the first time PH12 has been reported since 1939. —L.J.K.

GSK, 26.10m, has at last been heard by Dr. Gaden. He says the signal fluctuated badly, even fading right out at times. Static was bad. He has "caught" them several times and has at last found out what had been worrying him. He discovered that the harmonic of WNRI, 13.05 mc, was coming in with GSK and accounts for the foreign language being heard about 10.15 p.m.

With the BBC putting in such excellent signals at night, here is a chance to hear a bedtime thriller, Inspector Cameron's Cases, from 11.15 till 11.30 on Thursdays. Probably the best signal would be on either GSJ, 21.53mc; GVO, 18.08 mc; GSV, 17.81mc; GSG, 17.79mc; GVQ, 17.73mc; GSF, 15.14mc; or GWG, 15.110mc.

Here are some interesting daily sessions heard well, "What American Commentators Say," KRHO, 16.85m, 11.45 a.m., and over KCBR, 19.65m, at 12.45 p.m., "The Washington Reporter."

For the all-nighters, a nice break can be had on Wednesday mornings at 1.15 by tuning to WLWL, 17.955 mc, 16.70m. You will be taken to Ciro's Night Club in Mexico City. After 15 minutes of gay music, a more sober fare is provided by the Crosley Corporation in the shape of news.

Mr. Arthur Cushen advises he has heard PCJ, Huizen, testing to South America, at 11 a.m.-noon on 9.59 mc, 31.30m.

Wally Young reports hearing WNRX, New York, on 7.25mc, 41.38m, at 7 a.m., and WNRE, New York, 9.75mc, 30.77m, at 8.30 a.m. Looks at though the old headache of "what call was that?" is on again.

Dr. Gaden says, "The lady announcer at the Ceylon station on about 4.90mc gives w/l as 61.22m.; that makes YV-5RM lower w/l than usually published. By my arithmetic, 4.89mc is about 61.35m, which goes well with the 61.22m of the Ceylon lady." (My records are: YV-5RN, Caracas, 60.97m; ——, Colombo, 4.90mc, 61.22m; YV-5RM, Caracas, 4.89mc, 61.35m.—L.J.K.) Dr. Gaden goes on to say that YV-5RM dropped the "Woodpecker Song" but is using it again. On a quiet night he can keep them tuned till 10 o'clock. 5RN is fairly consistent, but YV-5RU, also at Caracas, 4.86mc, is a washout, lasts about 10 minutes only.

I was reading where Rex Gillett figured he had heard Radio Vienna behind COBL, Havanna, on 9.82mc, 30.51m. The signal, whilst not possible to absolutely identify, was too strong to permit of copying COBL. It is quite possible he did hear Radio Vienna, as they are listed to be on the air till about 10.30 a.m., but is interfered with by GRH, 9.825mc, 30.53m. The frequency given in "Universalite" for Vienna is 9.823 mc.

From the same magazine I found that COBL had replaced COCM. I then turned up the latest copy I had of "Radio Guia" (July issue) and there is a typographical error in that paper, as they show COBL as 9.63mc, 30.51m, which wavelength is wrong; it should be 31.15 m, for 9.63mc I think it should read 9.823mc, a wavelength of 30.54m, which would account for Rex hearing the two stations together.

NEW STATIONS

VLA-3, Shepparton, 9.68mc, 30.99m: Commenced regular schedule as from 12th November in transmission to Britain from 1.15-1.45 a.m. in parallel with VLG-5 and VLC-8.—L.J.K.

Alterations to Department of Information Overseas Broadcasts as from 12th Nov.:

VLC-4, Shepparton, 15.315mc, 19.59m: To Forces, North Australia. Noon-2 p.m. in parallel with VLG-6 and VLA-6. British Pacific Fleet programme 2-3 p.m. in parallel with VLA-6. To Tahiti in French, 4-4.40 p.m., in parallel with VLG-3.

VLC-8, Shepparton, 7.28mc, 41.21m: To Britain, 1.15-1.45 a.m. in parallel with VLG-5 and the new transmitter, VLA-3, 9.68mc.

VLA-3, Shepparton, 9.68mc, 30.99m: Replaces VLA (7.28mc, 41.21m), to Britain, 1.15-1.45 a.m.

VLA, Shepparton, 7.28mc, 41.21m: In programme to India from 12.35 a.m., now closes at 12.45 a.m.

CANCELLED:

VLC-4, to North America, 11.55 a.m.-12.45 p.m.

VLC-7, to Tahiti, 4-4.40 p.m.

VLC-2, to Britain, 1.15-1.45 a.m.

VLA, to Britain, 1.15-1.45 a.m.

——, Durban, 6.17mc, 48.62m: This South African, although shown in the "Universalite" S/W Log for over six months, and without a call-sign, has only just been logged in Australia, and the fortunate DX-er is Ern Suffolk, of Lobethal, S.A. (In this instance, South Australia.) It is a nice catch, and Mr. Suffolk is to be congratulated. He says he heard them opening with a musical programme in relay with Pietermaritzburg at 2 a.m., announcements being in Afrikaans. From 5.30 it is compered in English. Signal, which had been good, fades by 7 o'clock.

ZRK, Johannesburg, 6.09mc, 49.26m: This is another from the same country, reported by Mr. Suffolk. He mentions signal as being very weak. Programme at 4.30 was in English and at 5 a.m. the BBC news was relayed and again at 6.45. The station appeared to close at 7 o'clock. (Mr. Suffolk does not give the call-sign, but I have shown it as ZRK as this was the call for Johannesburg on 6.097mc, 49.21m.)

Radio Omdurman, Anglo-Egyptian Sudan, 13.32mc, 23.92m: Here is an exceptionally fine catch by Rex Gillett. Heard at 3.30. Gives programmes in English on Fridays. The English session commences with "Colonel Bogey" march. Then announcement in English, "This is Omdurman calling." News items of local happenings are then read. Prior to English, programme is in Arabic.

Radio Omdurman, 9.22mc, 32.43m: Now being heard on this frequency in parallel with the above.

OFFICIAL LIST OF SWITZERLAND STATIONS

By Courtesy of The Victory Radio Club

Call-sign	Location	Freq.	W/L
HER-2	Berne	6.055	49.54
HER-3	"	6.165	48.66
HEI-2	"	6.345	47.28
HEI-3	"	7.21	41.61
HET-3	"	7.36	40.76
HEK-3	"	7.38	40.56
HEF-4	"	9.185	32.66
HER-4	"	9.535	31.46
HEI-4	"	9.539	31.45
HEO-4	"	10.338	29.01
HEF-5	"	10.363	28.95
HBO	Geneva	11.402	26.31
HEI-5	Berne	11.715	25.61
HEI-6	"	11.775	25.48
HER-5	"	11.865	25.28
HEK-4	"	11.96	25.08
——	Geneva	12.965	23.14
HBJ	"	14.538	20.64
HER-6	Berne	15.305	19.60
HEI-7	Berne	15.32	19.58
HER-7	"	17.784	16.86
HEI-8	"	17.795	16.85
HBF	Geneva	18.45	16.26
HER-8	Berne	21.52	13.94
HEI-9	"	21.605	13.88
HER-9	"	25.64	11.70

Swiss Broadcasts to Australia:

As from 13th November, the Swiss Broadcasting Corporation have added 14.462mc, 20.74m to their Tuesday and Saturday transmissions to Australia. So far I have not heard this new frequency, as noise will not permit of it, but on 11.715mc, 25.61m from 6-7.30 p.m. is, as usual, very good.

BBC Pacific Service

Schedule is still 4-8 p.m., but here are some alterations that came into force from 18th November:

GSN, 11.82mc, 25.38m: Now beamed to Australia from 4-8 p.m.

GSI, 15.26mc, 19.66m: Now opens at 4 p.m., instead of 4.30.

GVP, 17.70mc, 16.95m: This is a new frequency for the service and is beamed to Australasia from 5.30 till 8 p.m.

GRV, 12.04mc, 24.92m: Has been withdrawn.

The MONTH'S LOGGINGS

ALL TIMES ARE EASTERN AUSTRALIAN STANDARD TIME

Pressure on space only permits of unusual Loggings or alterations in schedules or frequencies.

Readers will show a grateful consideration for others if they will notify me of any alterations. Please send reports to L. J. Keast, 23 Honiton Avenue W., Carlingford. Urgent reports, 'phone Epping 2511.

OCEANIA

Australia

Several alterations to D.O.I. overseas services shown elsewhere.

VLW-7, Perth 9.52mc, 31.51m
Can generally be relied on for BBC News at 8.45 a.m.—L.J.K.

VLG-7, Melbourne ....: 15.16mc, 19.79m
Great from 6 a.m.; fine breakfast music (Cushen). (Schedule is: 6-8 a.m.; Sundays 6.45-8.15).—L.J.K.

Guam

KU5Q 15.92mc, 18.84m
O.K. at 10.30 a.m. (Young).

KU5Q 13.39mc, 22.40m
Heard calling KEB at 11 p.m. (Young).

New Caledonia

FK8AA, Noumea 6.208mc, 48.39m
Very good at 6.30 p.m.

New Zealand

ZLN-4, Wellington 9.876mc, 30.37m
Heard at 5 p.m. (Young).

Philippines

PY-10, Manila 18.56mc, 16.16m
Heard talking to KBE at 9.30 a.m. (Young). (Note slight change in frequency . . . was on 18.54mc—.L.J.K.)

AFRICA

Algeria

AFHQ, Algiers 11.76mc, 25.51m
At 11 p.m. in Czechoslovakian; at midnight, News in German in relay with a number of U.S.A. East Coast stations (Edel).

Belgian Congo

RNB, Leopoldville 17.775mc, 16.88m
Some nights O.K.; others poor; others not a whisper (Gaden). News in French at 10 o'clock (Edel).

Gold Coast

ZOY, Accra 7.295mc, 41.13m
Has been heard with English programme prior to leaving the air at 4 a.m. with "God Save the King" (Gillett).

Mozambique

CR7BE, Lourenco Marques, 9.70mc, 30.93m
Gives programme details in Portuguese and English at about 5.05 p.m. Musical programme follows but is spoilt by WLWR (Gillett). (Good reliable signal at 5.55 a.m. when giving news in English. From 6 till closing at 6.30, dance music.—L.J.K.)

THE EAST

China

XMEW, Kunming 16.54mc, 18.14m
AFRS programme at 9.30 p.m. . . . poor signal at this time and much morse interference (Edel).

XORA, Shanghai 11.695mc, 25.65m
This is the new call heard. Progs. are of recorded music and Chinese language (Gillett). (This frequency has been variously XGRS and XGOO.—L.J.K.)

XGTA, Shanghai 11.65mc, 25.75m
Heard at good level nightly around 10 o'clock (Gillett). (This is the frequency used at one time by XGOK or XGKO, Canton.—L.J.K.)

XGOY, Chungking 6.14mc, 48.86m
Heard signing off at 2.45 a.m. (Edel).

Portuguese China

Radio Macao, Macao 7.525mc, 39.85m
Goor at 9 p.m. (Young). Has news in English, lady announcer at 10.40 (Cushen).

French Indo China

Radio Saigon 4.81mc, 62.37m
Good signal here in chain with 11.775 outlet (Cushen).

Thailand

HSP-5, Bangkok 11.71mc, 25.61m
Good signal at 9 p.m.

India

Radio SEAC, Colombo 11.755mc, 25.52m
Seemed to have moved from 11.765mc. Signals are good about 12.30 a.m. (Gillett).

GREAT BRITAIN

BBC, London

GSK 26.10mc, 11.49m
Heard a few times (Gaden). (See remarks elsewhere.—L.J.K.)

GVT 21.75mc, 13.79m
Daily broadcast in French at 9.45 p.m. R7-8 (Edel).

GSJ 21.53mc, 13.93m
R9 in Sport parade at 10 p.m. (Edel).

GVQ 17.73mc, 16.92m
R8 at 10 p.m. (Edel).

GVP 17.70mc, 16.95m
Now heard in Pacific Service from 5.30-8 p.m. Good.—L.J.K.

GRA 17.715mc, 16.94m
Also R8 at 10 p.m. (Edel).

GSP 15.31mc, 19.60m
R7-8 at 10 p.m. (Edel).

GWR 15.30mc, 19.61m
Very good at 10 p.m.

GSF 15.14mc, 19.82m
Excellent at 10.30 p.m.

GSD 11.75mc, 25.53m
Very good at 11.30 p.m. and splendid signal at 1.30 a.m. (Young). Good for news at 6 a.m.—L.J.K.

GRU 9.915mc, 30.26m
Very good signal at 6.15 a.m. Schedule is: 3.30-6.30 a.m.; 6.45-7.45 a.m.—L.J.K.

GWT 9.675mc, 31.01m
Good at 7 a.m.

GRY 9.60mc, 31.25m
Choose this for news at 6.45 a.m.—L.J.K.

GSB 9.51mc, 31.55m
News at 6 a.m.—L.J.K.

GSA 6.05mc, 49.59m
Nice signal at 7.30 a.m. (Young).

U.S.A.

San Francisco unless otherwise mentioned.

KNBA 17.78mc, 16.87m
Excellent signal when closing at 7.45 a.m.—L.J.K.

KNBI 15.34mc, 19.56m
Heard closing at 7.45 a.m. . . . good signal.—L.J.K.

KGEX 15.21mc, 19.72m
Very good at 3.45 p.m.

KCBR 13.05mc, 22.96m
Good signal when closing at 4 p.m.—L.J.K.

KWIX 11.89mc, 25.23m
Now being heard at 3.45 p.m.

KWID 9.855mc, 30.44m
Very good signal when closing down at 9.30 p.m. (Edel).

KCBR 9.70mc, 30.93m
News in English at midnight. News in Cantonese at 12.05 a.m.—L.J.K.

KGEI 9.55mc, 31.41m
R7 when closing at 1.45 a.m. (Edel).

KES-2 .... 8.93mc, 33.58m
Very good at 11 p.m. (Young).

KNBX 7.805mc, 38.44m
From 8 p.m. excellent—my favourite (Gaden).

KGEX 7.25mc, 41.38m
Heard in Chinese at midnight (Edel).

KWID 7.23mc, 41.49m
Now opens at 9.45 p.m.—L.J.K.

U.S.A.

Other than 'Frisco

WNRA, New York 18.16mc, 16.52m
News in German in relay with 9 more U.S.A. stations at midnight (Edel).

WCBN, New York 17.83mc, 16.83m
Good at 11.45 p.m. (Edel).

WNBI, New York 17.78mc, 16.87m
Italian at 11.45 p.m. (Edel).

WLWO, Cincinnati 17.80mc, 16.85m
Very good at 11.45 p.m. (Edel).

WRUW, Boston 17.75mc, 16.90m
In relay with WNBI at 11.45 p.m. (Edel).

WRUA, Boston 15.35mc, 19.54m
O.K. at midnight.

WLWR, Cincinnati 15.25mc, 19.67m
Heard in excellent musical programme with English and Spanish announcements at 5.45 a.m. Splendid signal closes at 6 o'clock; says will re-open at 6.15 on 9.70mc, 30.93m.—L.J.K.

WOOC, New York 15.19mc, 19.75m
Very good at night. Now gives his wavelength as 19.75m instead of 19.7 (Gaden).

WNBI, New York 15.15mc, 19.81m
Very fine at 5 a.m. (Cushen).

WRCA, New York 15.15mc, 19.81m
News in English at 11 p.m. (Edel).

WLWS, Cincinnati 15.13mc, 19.83m
Good at 5 a.m. (Cushen).

WCBN, New York 11.145mc, 26.92m
Very good at 6.30 a.m. in AFRS; News at 7.—L.J.K.

WNRE, New York 9.75mc, 30.77m
Heard well at 8.30 a.m. (Young).

WLWL, Cincinnati 9.70mc, 30.93m
Announcements in Spanish at 6.15 a.m.

WNRX, New York 7.25mc, 41.38m
Good signal at 8 a.m. (Young).

WOOW, New York 6.12mc, 49.02m
Not bad when closing at 6.15 p.m. (Gaden).

SOUTH AMERICA

Brazil

PRL-8, Rio de Janiero 11.72mc, 25.60m
Good signal in English programme from Monday to Friday for British Isles. Closes at 6 a.m.—reports requested (Gillett).

Ecuador

HCJB, Quito 15.09mc, 19.87m
Very good signal at 11 p.m. but better on 12.445mc, 24.08m.—L.J.K.

U.S.S.R.

Moscow unless otherwise mentioned.

—— 15.34mc, 19.57m
Foreign language at 10 p.m.; Hindustan 10.30; French 11 p.m. (Edel).

—— 15.23mc, 19.70m
Good signal at 9.15 a.m.

—— 15.04mc, 19.95m
Heard in foreign language at 9.15 p.m. (Gillett). (I think this is still a further frequency for USSR.—L.J.K.)

—— 14.46mc, 20.75m
Good at 10.30 p.m. (Young).

—— 11.90mc, 25.21m
Heard around 11.30 p.m.

—— 11.632mc, 25.79m
Also heard at 11.30 p.m.

—— 9.48mc, 31.65m
Very good signal at 3 a.m. (Young).

MISCELLANEOUS

Azores

Emisora National, Ponta Delgado
11.09mc, 27.05m
Very good signal till station leaves the air at 7 a.m. (Gillett).

Angola

CR-6RA, Loanda 9.47mc, 31.69m
Closes with Portuguese National Anthem at 6.30 a.m. (Gillett).

Canada

CKNC, Sackville 17.82mc, 16.84m
In relay with CKCX and CHOL, 25.60m, after 1 a.m. (Edel).

CHCX, Sackville 15.19mc, 19.75m
Heard well most nights around 10 p.m.; still on at 1.30 a.m. and programme for European listeners is audible at 7 a.m. At 4 a.m. is best signal on 19-metre band (Cushen). Signal at 7.30 a.m. in English and French seem to have been in parallel with CHOL, which does not close then (Gaden). Weak at 11.30 p.m. (Edel).

CFRX, Toronto 6.07mc, 49.42m
Heard with musical programme around 10.30 p.m. (Gillett).

Czechoslovakia

OLR-3A, Prague 9.55mc, 31.41m
Good strength in French at 4.45 a.m.—closes at 5 o'clock.

Holland

PCJ, Hilversum 15.22mc, 19.71m
Heard from 11 p.m.-12.30 a.m. in programme to Dutch East Indies.

Italy

Milan Radio, Milan 9.635mc, 31.14m
Heard at 5 a.m. at good strength, news broadcast in Italian at this time; dance numbers from 5.15. Announcers male and female. Relay broadcast transmitter. Use 2-note piano as identification signal (Cushen).

Madagascar

Radio Tananarive 4.35mc, 68.96m
Heard in French . . . closes at 2 a.m. (Edel).

Radio Tananarive 12.135mc, 24.72m
Music at 11.15 p.m. "Ici Tananarive" then Asiatic language . . . strong morse (Edel).

Mexico

XEWW, Mexico City 9.50mc, 31.58m
Has been out on its own, closing 4.45 p.m.; best ever from this fellow at that time (Gaden). (Very good also at 11 p.m.—L.J.K.)

Sweden

SDC, Stockholm 10.775mc, 27.83m
Heard giving programme at 11.30 p.m. for America (Young).

Spain

Radio National Espana, Madrid
9.37mc, 32.02m
Good signals between 6 and 6.30 a.m. with talks in English punctuated by musical items.

Turkey

TAQ, Ankara 15.19mc, 19.74m
Heard opening at 3.30 p.m. (Cushen).

TAP, Ankara 9.465mc, 31.70m
Heard closing at 7.15 a.m.—L.J.K.

Vatican State

HVJ, Vatican City 11.74mc, 25.55m
Heard them at unusual time of 8.15 p.m. in Spanish calling Radio Madrid . . . sig. fairly good (Gillett). Can be heard opening at 12.30 a.m. Programme lasts 30 minutes.

HVJ, Vatican City 9.66mc, 31.06m
In French at 1 a.m.

HVJ, Vatican City 5.968mc, 50.26m
Heard reading in Italian P.O.W. names at 1.35 a.m. (Gillett).

Yugoslavia

Radio Belgrade, Belgrade, 9.42mc, 31.85m
Received well at 5 p.m. with news in French (Cushen). Appeared to leave the air at 11 p.m. following foreign programme.

SPECIAL APPEAL FOR BACK NUMBERS

After four years in the RA.A.F., two and a half of which were spent in England as a Lancaster pilot, one of our keenest readers has returned to find that his files of back numbers are not complete and he needs the following issues so that he can get the volumes bound. Will any one who can help by supplying these issues please get in touch direct with Mr. D. H. Stitt, 8 Carter Street, Gordon, N.S.W. The issues required are: Volume 7, Nos. 1, 2 and 3 (June, July, August, '42), Volume 8, Nos. 1, 2, 3, 4 and 5 (June, July, August, September, October, '43). Mr. Stitt says he is more than willing to go to any lengths to obtain these issues. He has duplicates of Vol. 8, No. 6, and Vol. 9, Nos. 5, 6 and 7 for exchange if these will help.

I.R.E. EXAMS

The Institution of Radio Engineers, Australia, will be holding its half-yearly examination for admission to the Graduate and Associate Member grades, and the Radio Service Technicians examination for the Service Division of the Institution on Saturday, February 2, 1946.

Intending candidates are invited to apply to the General Secretary, The Institution of Radio Engineers Australia, Box 3120, G.P.O., Sydney, before 15/1/46.

* * *

Chairman of the A.B.C. says that "radio would be a God-given thing if it were used to keep the democratic peoples of the world in close and free contact with each other." Correct!—but there is a vast difference in the effect of the applications of radio! Listeners in other countries are instinctively suspicious of the motives, however sincere they may be, behind broadcasts originating in other countries. Not with Amateur Radio. There lies the answer to Mr. Boyer's plea. There is no suspicion accompanying contact between two foreign radio amateurs —but a feeling of genuine friendship and goodwill. The more quickly that politicians with democratic labels to their calling wake up to the value to world peace of Amateur Radio—the better.

Speedy Query Service

(Conducted under the personal supervision of A. G. Hull)

K.C.J. (Benalla) wants details of construction of a really good valve tester.

A.—The design and construction of a good valve tester, especially one to take all types of valves and give them a thorough testing, is quite difficult. The valve testers at present on the market are comparatively crude, and few will detect a gassy valve, for example. We are giving the whole subject considerable thought at the moment and may be able to manage an article on it shortly.

* * *

A.J.V. (Boggabri) enquires about suitable metal for a base for an amplifier.

A.—The usual base material is ordinary sheet steel or black iron, covered with sprayed lacquer or cadmium plated. Copper and aluminium were popular some time ago. All these materials are quite satisfactory from an electrical point of view. It is always a wise precaution to run a separate earthing wire so as not to depend on the base for the entire earth return.

* * *

H.A. (Sydney) asks about back numbers.

A.—Yes, the numbers you require are available from stock. Price is 1/- each, post free.

* * *

T.D., (Bexley) has a voltmeter with scale to 6,000 volts A.C., but finds that it reads full scale when a "B" battery is tested with it.

A.—The battery will be giving di-
tended for alternating current. That
rect current, whilst the meter is in-
is one possible explanation, but it is also quite on the cards that the meter was intended for use only with a series resistor in circuit. Without seeing the meter it is hard to say whether it can be adapted for radio work, but the prospects are not bright.

* * *

E.M.H. (Ballarat) writes about coils.

A.—We would think that at least 95 per cent. of modern coils are wound of litz wire in honeycomb pies, and consequently any constructional data would be of little value to anyone wanting to wind coils at home.

* * *

T.P. (Bondi) has a broken-down set with a blue glow in the type 45 output valve, but when tested by a local dealer the valve appeared reasonably O.K.

A.—This would indicate that the coupling condenser between the plate of the detector and the grid of the output valve has broken down, thereby short-circuiting the high-tension on to the grid. This will soon ruin the valve if you leave it switched on for long in that condition.

HAM NOTES

(Continued from page 28)

tionate prices to the public. Thus we pay for the war twice over! Ex-service Hams particularly should **have first right** to obtain usable gear at shallow pocket prices.

Before authority clamped down on the jolly Roger transmissions in the S.W.P.A. on 20 m. phone and C.W., I was highly annoyed by remarks from a "VK9 in Southern N.G.," who said he was a VK2 normally. The QSO was with an American on Iwo Jima—a W9 of lengthy pre-war experience, who recalled VK2's he knew on the air before the big "shut down." Particularly did he touch on "VK2GU, who had a whale of a sig on ten." Our N.G. exponent with the 700 watts of service phone opined that he "had never heard of 2GU, and couldn't place him." Somebody should tell him that H. E. Cox (VK2GU, of Canberra) ranks as one of the 28 Mc/s DX pioneers; has played a most important part in the "rehabilitation" of Australian amateur radio now taking place, and that for these services he has been voted a life member of W.I.A. But as the "VK9" was, according to his own conversation, not actually a VK2 himself—but "second op" at "various" stations, perhaps the lack of knowledge is understandable. My guess, incidentally, is that authority will slam down hard upon "second op" masqueraders.

* * *

Whether or not the South Americans (PY's) heard on "20" are "official," they appear definitely to be located in that part of the world, judging by the rush of S.W.P.A. "unofficials" to QSO them. Another much sought-after call is D4USA, which, as the sign may indicate, may be a W Ham "somewhere in Germany." Speaking of "manufactured" callsigns as at present extant on "20," one gem is W9000 (three Zero's in a row), to say nothing of W8UBL. The latter I leave to the peruser of these notes to work out for himself!

BATTERIES

(Continued from page 25)

of parts manufacturers are turning their attention to the production of miniature components to go with these valves. Naturally volume and weight are the primary consideration in the "personal" portable and consequently the No. 467 battery has been made as small as practicable, measuring 2 13/16in. long by 1⅜in. wide by 3 21/32in. high and weighing only 12oz. A further saving in space is effected by the use of glove-fastener type terminals.

This battery is now available from stock and can be supplied to anyone possessing an American "personal" portable receiver or other special equipment which cannot take a larger size battery.

The "Eveready" No. 745 and No. 482 batteries have been designed for use with a normal four or five-valve portable receiver and at the average current drains encountered in this type of receiver, say, 300 mA "A" current and 10-12 mA "B" current, both "A" and "B" batteries will give approximately the same amount of service. It will be appreciated, of course, that the life of a set of batteries depends a great deal upon the design of the receiver and also upon the intermittancy of use. It is generally considered good practice to design a portable receiver for a cut-off of 1.1 volts for the filaments and 1.0 volt per cell for the "B" battery and these batteries have been designed to give good service to these end-points.

THIS MAN GOT HIS JOB BECAUSE HE WAS TRAINED!

WHAT'S IN YOUR FUTURE?

Will the end of the war find you looking around anxiously for any type of employment because you belong to the tragic ranks of the unskilled?

If so, get to work immediately and join the ambitious young men who realise that Radio offers them limitless opportunities for advancement and an assured future.

SECURE YOUR POSITION IN THE POST-WAR WORLD WHILST FOLLOWING YOUR PRESENT OCCUPATION

LOOK WHAT A.R.C. HAS DONE FOR THIS MAN

"I'm blessing the day I started learning Radio at the A.R.C. As things stand at present, I have earned enough to cover all my expenditures. These include: (1) the Course paid for; (2) two meters, value pre-war £26—worth a lot more now; (3) four radios to learn on and experiment with, plus a fair amount of stock on hand, value roughly £15; and, best of all, worth more than all, a decent future."

—H.B., Western Australia

GLUING WOOD WITH RADIO WAVES

Incredible as it may seem, an R.F. "spot-gluer" has been tested under Active Service conditions similar to those of ordinary production. Exhaustive tests have clearly demonstrated that this process can successfully be used for tacking together layers of wood veneer. This operation is necessary to mould plywood shapes, such as aircraft fuselages, wing elements, stabilizers, etc. Here is a great new application of Radio which speaks well for the future. Truly it may be said "Radio wonders will never cease."

YOU CAN START RIGHT AWAY

Of the many industries crying out for skilled men, none is more important to the Nation than Radio. We offer you the opportunity to enter Radio either in industry or in the fighting forces. Here are three good reasons why you will benefit if you become Radio Trained:—

1.—You will enter today's most progressive industry.

2.—You will be pulling your weight in the war effort.

3.—You will have a splendid career ahead of you when the war is over.

COSTS LITTLE

Think of this—for a few pence per day—actually less than many fellows spend on tobacco—you can prepare yourself for a man-sized job in Radio.

AUSTRALIAN RADIO COLLEGE PTY. LTD.

Cnr. BROADWAY & CITY ROAD
SYDNEY - Phone M6391—M6392

PREVIOUS KNOWLEDGE UNNECESSARY

You don't need a knowledge of Radio or Electricity. We'll give you all you need of both—you'll start at the beginning, building up knowledge just as carefully and systematically as you would lay brick after brick in its place when building a wall. You get the knowledge you want presented in a manner that makes it easy to learn FAST.

SEND FOR THIS FREE BOOK

First thing to do if you want to secure the facts about Radio is to send in for "Careers in Radio and Television," a lavishly illustrated book published by the College and available to approved enquirers. Send in coupon your copy now. It's free and post free.

To Mr. L. B. GRAHAM, Principal,
Australian Radio College Pty. Ltd.
Broadway, Sydney. 'Phone, M 6391-2

Dear Sir,—I am interested in Radio. Please send me, without obligation on my part, the free book, "Careers in Radio and Television."

NAME ....
ADDRESS ....
.... A.R.W.2.

Printed by the Bridge Printery, 117 Reservoir St, Sydney, N.S.W., for the proprietor of the "Australasian Radio World," Elizabeth St., Sydney.