ELECTRIFY YOUR GRAMOPHONE (SEE SPECIAL ARTICLE)

Wireless Magazine

EDITOR: BERNARD E. JONES

TECHNICAL EDITOR: J.H. REYNER, B.Sc. (Hons.) A.M.I.E.E.

VOL. 7, No 40
MAY, 1928
1/-

The Sunshine Five

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Two-programme Two	W.M.56	1	0
Britain's Favourite Two and copy "A.W."	A.W. 74	0	4
Home and Abroad Two	A.W. 77	1	0
Two-wave Two	A.W. 83	1	0
Q-coil Two	W.M.62	1	0
†All-broadcast Two	W.M. 5	1	3
Two-valver embodying KL1 Valves	A.W. 5	1	0
One-control Two	A.W. 6	1	0
Safeguard Two	A.W. 3	1	0
†Loftin-White Two	W.M. 20	1	3
Remote-control Two	A.W. 23	1	0
Ultra-selective Hartley Two	A.W. 90	1	0
Trapped Reinartz Two	A.W. 92	1	0
Oceanic Short-wave Two	A.W. 91	1	0
★**Flat-dweller's Two**	**W.M.**	1	0
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†Hi-mu R.C. Three	W.M. 9	1	3
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Purity Three-valver	A.W. 33	1	0
Modern Tuned Anode Three	A.W. 35	1	0
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"Simpler Wireless" All-from-the-Mains Receiver	A.W. 41	1	0
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"Economy" Three	A.W. 48	1	0
Short-wave Three	A.W. 50	1	0
Ether Searcher Three	A.W. 52	1	0
Tuned-Anode Three—from the Mains (D.C.)	W.M.43	1	0
Three Continent Three	A.W. 54	1	0
Standard Three	A.W. 56	1	0
Screened-grid Short-waver	W.M.51	1	0
Hartley DX Three	A.W. 63	1	0
Britain's Favourite Three and copy "A.W."	A.W. 72	0	4
Straight Line Three	A.W. 60	1	0
Metropolitan Three	W.M.48	1	0
Everyday Three	W.M.52	1	0
Music Charmer	W.M.60	1	0
Broadcast Three	A.W. 76	1	0
Ridley Short-wave Three	A.W. 80	1	0
Selectus Three	A.W. 81	1	0
"Q" Coil Three	A.W. 84	1	0
Britannia Three	W.M.67	1	0
Clarion Three	A.W. 88	1	0
Broadcast Three	A.W. 76	1	0
Ridley Short-wave Three	A.W. 80	1	0
Selectus Three	A.W. 81	1	0

THREE-FOUR-VALVE SETS

Tuned-anode Three-four	A.W. 49	1	6
Concord Three-four	W.M.45	1	0
Trapped Three-four	W.M.61	1	6

FOUR-VALVE SETS

Distance Getter	A.W. 10	1	6
DX Four	A.W. 18	1	6
M.C. Four	A.W. 8	1	6
Household Four	A.W. 17	1	6
Reverberation Four	W.M.24	1	6
"A.W." Gramo Radio	A.W. 40	1	6
All-purpose Four	A.W. 43	1	6
All-wave Roberts Four, and copy of "A.W."	A.W. 47	0	7
Simplicity Four	W.M.49	1	6
C.T. Four	A.W. 58	1	6
"Simpler" Wireless Four	A.W. 70	1	6
Astral Four	W.M.53	1	6
Station-finder Four	W.M.68	1	6
I.H.C. Four	A.W. 87	1	6
★**Gramo-radio Four**	**W.M. 70**	1	6
★"Q" Coil Four	W.M.	1	6

FIVE-VALVE SETS

1927 Five	W.M. 6	1	6
Two-volter's Five	W.M.11	1	6
Individual Five	A.W. 25	1	6
Exhibition Five	W.M.33	1	6
Phoenix Five	W.M.42	1	6
1928 Five	W.M.46	1	6
All-the-world Five	W.M.63	1	6
The School Five	A.W. 85	1	6

SIX-VALVE SETS

Nomad Six	W.M.31	1	6
Short-wave Super-Six	A.W. 67	1	6

SEVEN-VALVE SETS

Simpladyne Seven (Super-het)	W.M.22	1	6

AMPLIFIERS

All-broadcast Amplifier	W.M.10	1	0
Range Extender (H.F. amplifying unit)	W.M.38	1	0
Two-valve D.C. Mains Amplifier	W.M.16	1	0
Gramophone Amplifier	W.M.32	1	0
True-tone Amplifier	W.M.47	1	0
Utility Two-valve Amplifier	A.W. 68	1	0
Screened-grid H.F. One	A.W. 5	1	0
One-valve L.F. Amplifier	A.W. 79	1	0
An "Add-on" H.F. Unit	A.W. 82	1	0
Push-pull Amplifier	A.W. 86	1	0

PORTABLE SETS

Springtime Portable (two-valver)	W.M.12	1	0
Countryside Four	W.M.17	1	6
Motorists' Portable (four-valver)	A.W. 14	1	6
M.C. Three Portable	A.W. 22	1	0
Handy Three	W.M.27	1	0
Holiday Portable (three-valver)	A.W. 32	1	0
Club Portable (three-valver)	A.W. 30	1	0
The Easter Portable (seven valver)	A.W. 89	1	6
Table Grand (Four-valver)	A.W. 93	1	0
★**The Sunshine Portable**	**W.M.74**	1	6

CRYSTAL SETS

Crystal Set for the R.C. Enthusiast	W.M.13	0	6
Hi-lo Crystal Set	W.M.18	0	6
Fonotrol Crystal Set	W.M.14	0	6
Two-programme Crystal Set	W.M.25	0	6
Alternative-programme Crystal Set	A.W. 39	0	6
Half-hour Crystal Set	W.M.28	0	6
Centre-Tap Crystal Set	W.M.50	0	6
Super Crystal Receiver	A.W. 64	0	6
Tapped-coil Crystal Set	A.W. 95	0	6

MISCELLANEOUS

†Loud-speaker Tone Control and Filter Unit	W.M. 1	1	3
Heterodyne Wavemeter	A.W. 7	1	0
Made-to-measure Wave Trap	A.W. 19	0	6
New Current Supply Idea	A.W. 26	1	0
DX One Valve Unit	A.W. 37	1	0
Battery Eliminator for A.C. Mains	W.M.41	1	0
Battery Eliminator for D.C. Mains	W.M.59	1	0
Volume Control Unit	W.M.40	0	6
"Simpler Wireless" Rectifying Unit	A.W. 62	1	0
H.T. Supply from A.C. Mains	A.W. 73	1	0
A.C. Mains Adaptor (for any "Simpler Wireless" Set)	W.M.57	1	0
Cone Loud-speaker	W.M.55	1	0
Moving-coil Loud-speaker	W.M.58	1	0
Emission Tester and Parallel-valve Unit	W.M.65	1	0
Simple Wavetrap	W.M.64	1	0
True-tone Filter Unit	A.W. 94	1	0
★**Portable Cone Loud-speaker**	**W.M.73**	1	0

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CONTENTS

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THE EDITOR COMMENTS FOR THE READER

THE demand for a first-rate portable set has been more insistent this spring than ever I have known it before, and in offering in this issue Mr. Reyner's Sunshine Five I know I am going a long way towards meeting the need. I am rather critical of portables, and I took home Mr. Reyner's set for the week-end expecting what I always inwardly label as a "portable" result. But I didn't get it!

In a village over a score of miles out of London, on the south-west side, 5GB filled the room and 5XX filled the house—a small house, of course—the sort an editor can afford. The Sunshine Five looks good, is well arranged, its circuit and components are unusual, the tone quality is satisfactory, and I believe that it will create great interest.

This month sees the introduction of "New Sets and Apparatus Tested" in the place of "Novelties and New Apparatus," and from this you may definitely conclude that our future policy is to give attention to manufactured sets as well as those of our own designing.

We are illustrating these test reports with informative photographs especially prepared by ourselves, and our notes will relate to both the performance of the sets and the method of use.

With regard to controversial broadcasting, on which in past months we have had much to say, we are now able to explain, on the authority of the B.B.C., exactly how they will arrange their controversial broadcasts, and in addition we present an article by a Labour M.P. giving his views—well-considered and brightly expressed—on the very vexed question of the broadcasting of Parliamentary debates.

In "Amateur Wireless" a week or so ago (No. 305) I published a remarkable article entitled "Television Forty Years Ago," in which it was shown how Nipkow, a German inventor, had anticipated many of the details of Mr. Baird's system of television. Now, in this issue of WIRELESS MAGAZINE, *I give what I consider to be a still more extraordinary instance of anticipation.*

It appears that Mahlon Loomis, an American, communicated in 1865 over a distance of about fourteen miles without the use of inter-connecting wires, the whole of the energy required being collected from the atmosphere by means of kites. It is, I suppose, safe to surmise that in both these cases the inventors would have gone far had there been available at that day even a fraction of the advanced scientific electrical knowledge we now enjoy.

I think everybody will read "Thirty Years Before Marconi?" with genuine admiration for a pioneer who did so much, but whose name has hitherto occupied so small a place in the history of wireless science. Loomis died in poverty.

Special attention is being paid in this issue to the electrical gramophone, there being a constructional article on the Gramo-Radio Four, and, in addition, an article entitled "Electrify Your Gramophone!" which is illustrated with photographs of some of the best known "pick-ups" available.

"Is a Moving-coil Loud-speaker Worth While?" is the question set forth by the title of an article which raises points which will certainly give the reader much food for thought, while the article will in itself act as an introduction to next month's special issue, in which the moving-coil loud-speaker will be very specially considered.

Instructions for building a really good instrument of this type will be given, and the whole subject, in which such great interest is being taken at the moment, will be explored. THE EDITOR.

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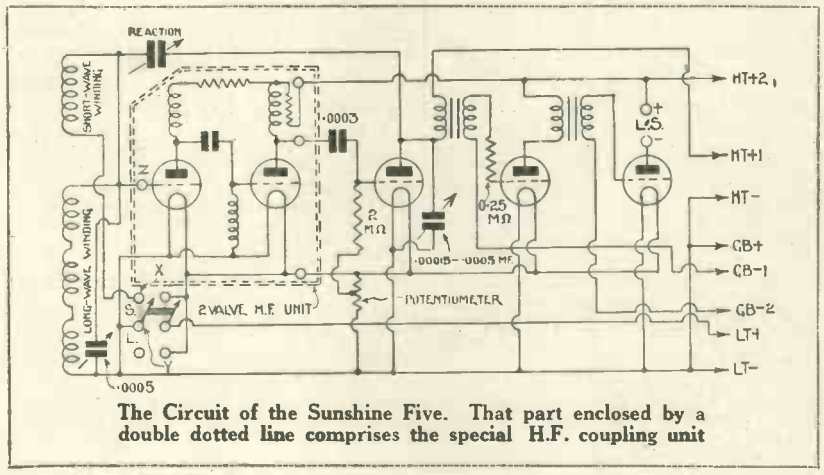
Nobody who wants a really good portable receiver—portable in every sense of the word—can do better than build that described in this article. It is the product of months of careful research work and will do everything that is claimed for it—as constructors can easily prove for themselves!

The Sunshine Five

DURING the past six months, I have been giving a great deal of attention to the problem of the portable receiver. In fact, my attention was directed to the subject even earlier than that, for, last July, I took the Countryside Four with me on a tour in Scotland in order to see what was possible in the way of more or less portable reception.



The Circuit of the Sunshine Five. That part enclosed by a double dotted line comprises the special H.F. coupling unit

What Is Required

This naturally gave me useful information regarding what was required. The matter was dropped during the autumn, but some six months ago I began to investigate the design of portable receivers again and some of the principal manufactured portable receivers were examined during this initial period.

The requirements considered desirable for a portable set were then drawn up, the chief features being as follows:

1.—The receiver to be completely self-contained. This means that the frame, loud-speaker and all batteries must be included in the cabinet.

2.—Only one tuning control.

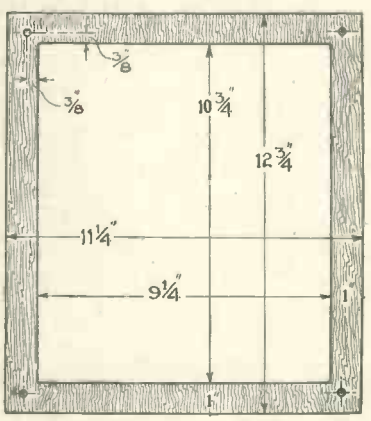
3.—Long and short waves both receivable, preferably without any coil changing.

4.—Real portability, involving low H.T. current consumption.

The last two factors are the ones which caused the greatest trouble in the design. Gang-control circuits can be ruled out as militating against simplicity and compactness, which means that some form of aperiodic coupling must be adopted.

Avoiding Coil Changing

If there is to be no coil changing then either two sets of transformers must be used, one for each wavelength, the connections being changed over by means of a switch, or alternatively a system must be adopted which covers both broadcast wavebands.



Details of the frame aerial

Numerous tests were made on the various forms of apparatus and it was

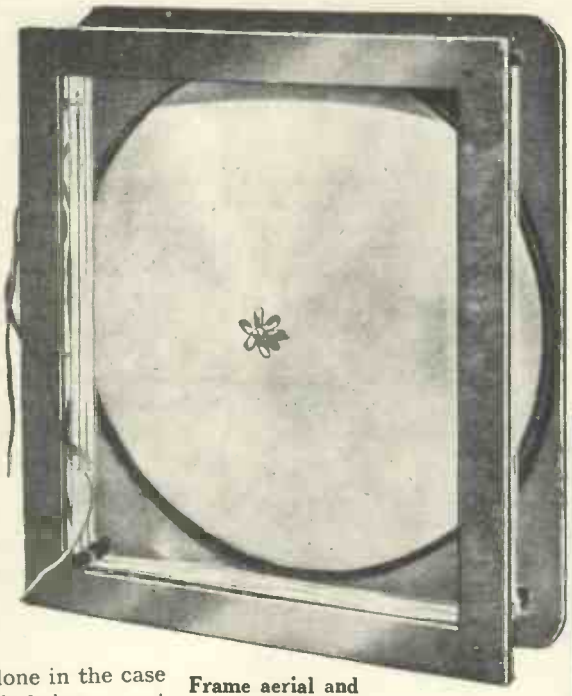
ultimately decided to utilise the Polar H.F. unit. This is a compact unit, giving two stages of aperiodic H.F. amplification, which covers the whole band from 250 to 2,000 metres.

The unit is made up in a small box, ready wired and incorporating a stabilising adjustment which overcomes one of the chief difficulties with this method. Our experiments indicate that any really efficient form of amplification, even if of the aperiodic type, was liable to oscillate unless some form of stabilising was adopted. This has been done in the case in question, the result being a neat unit capable of giving real amplification over the full band of wavelengths required.

The amplification is a little less than could be obtained by the use of special transformers for the two wavebands, but the greater convenience of having one unit to do the whole work was considered to outweigh this.

This left the fourth question to be settled, that of the portability, and here I have given no little thought to the matter. Portability means small size and this at once limits the area of frame aerial permissible. A large number of experiments were done with circuits of various types using a number of different frame aerial systems, and one is driven to the conclusion that a certain amount of efficiency must inevitably be sacrificed for compactness.

The present portable receiver as finally designed measures only 14 in. by 12 in. by 8½ in. overall, and as its weight is only 21 lb. it can be considered really portable. At the same time, the frame size is very small and particular trouble has to be taken to design the most efficient type of frame aerial system for the limited space.



Frame aerial and cone loud-speaker unit ready to place in lid of cabinet

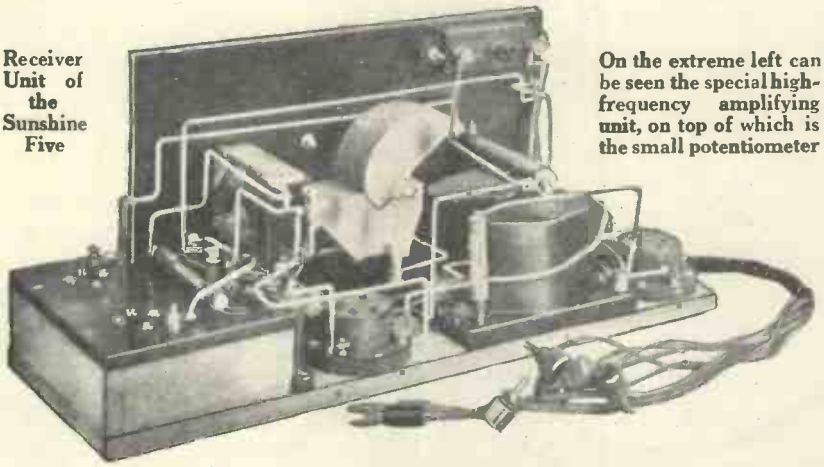
Above is a view of the Sunshine Five completed and ready for use

The Sunshine Five assembled. The flap at the front of the cabinet can be lifted up

Six Stations In Daylight

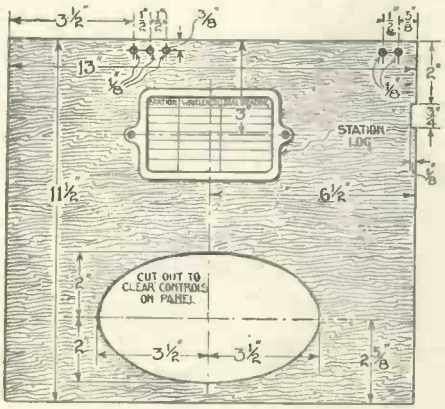
The result has been a receiver capable of receiving, at Elstree, about six stations in daylight and rather more than double this number after dark. The majority of the stations are naturally received on the long waves, where the effect of darkness

The Sunshine Five (Continued)



Receiver Unit of the Sunshine Five

On the extreme left can be seen the special high-frequency amplifying unit, on top of which is the small potentiometer

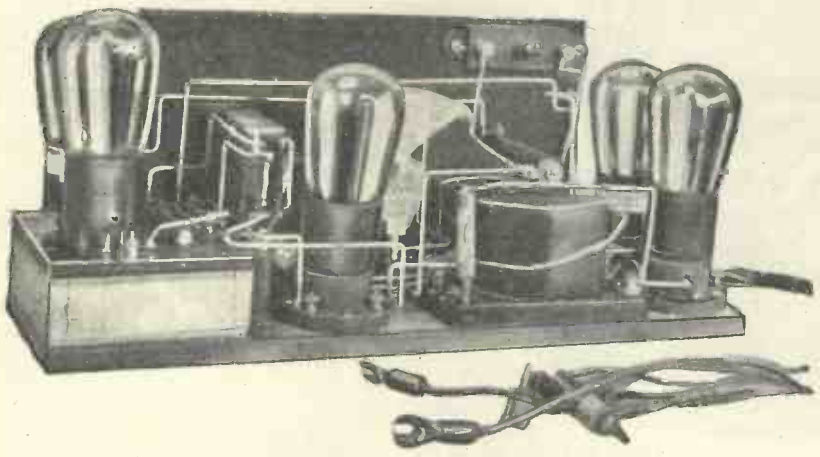


Details of wood top for cabinet

is not so marked, and I felt that the probability was that a receiver of this nature would enable one or two programmes to be received in all except the most outlying districts of the country.

The actual stations received are listed in the test report accompanying this article and my experiments indicate that this is, without doubt, the best performance which can be obtained with a straight five-valver of the small size of the present instrument.

The circuit is shown on page 294, and, is in the main, straightforward. There are two H.F. stages, incorporated in the unit already referred to, a detector and two transformer-coupled low-frequency stages.



A view of the receiving unit removed from the cabinet

Shielded L.F. Transformers

Mullard transformers have been used, since these are exceedingly compact and are enclosed in a metal case which can be earthed, thereby avoiding any interaction. An H.F. stopper, consisting of a resistance of ¼ megohm, is included in the grid leak to the first L.F. valve; this is distinctly beneficial in avoiding H.F. in the L.F. stages

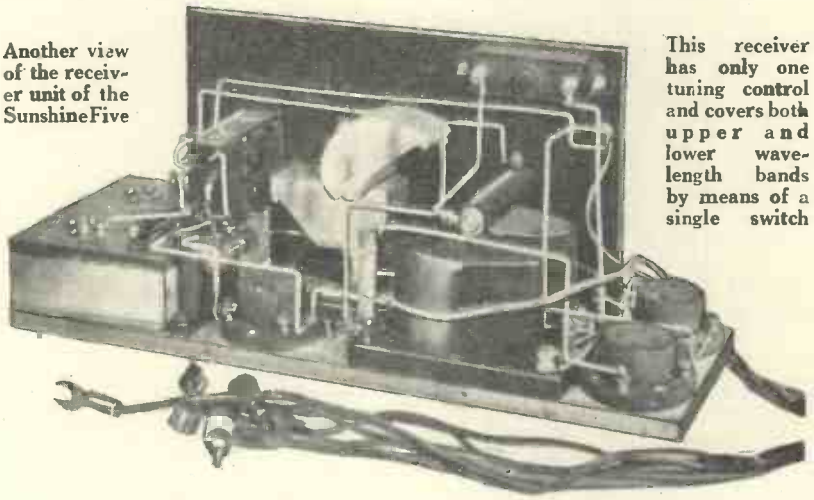
COMPONENTS REQUIRED

1—Ebonite panel, 9 in. by 5½ in. (Becol, Ebonart, or Will Day).
1—.0005-microfarad variable condenser (Formo 1928 Log or Peerless).
1—.0005-microfarad semi-fixed condenser (Formodenser or Igranic Pre-set).
1—Double-pole change-over switch (Burndept, Dubilier, or Ericsson).
1—High-frequency coupling unit (Polar).
3—Antimicrophonic valve-holders (Redferns, Lotus, Benjamin or W.B.).
2—Low-frequency transformers (Mullard).
1—Neutralising condenser (Gambrell).
1—.0003-microfarad fixed condenser, upright type (T.C.C. type S.P., Dubilier, or Lissen).
1—2-megohm grid leak (Dubilier, Mullard, or Lissen).
1—.25-megohm grid leak (Dubilier, Mullard or Lissen).
5—Wander plugs, 2 red and 3 black (Igranic, or Lectro Linx).
4—2 ft. lengths insulated wire (Glazite).
1—Six-way battery cord, 18 in. long, made up with pieces of flex (Lewcos).
4 oz. No. 22-gauge d.s.c. wire (Lewcos).
½-lb. No. 28-gauge d.s.c. wire (Lewcos).
1—Cabinet (Camco).
1—Loud-speaker unit complete with cone and frame (Six-sixty).
1—100-volt high-tension battery with grid-bias tappings (Ripault) or 100-volt battery without grid-bias tappings and 9-volt grid-bias battery (Lissen).
1—2-volt unspillable accumulator (Oldham SMV4).

Complete With Batteries and Loud-speaker Weighs 21 Lb.

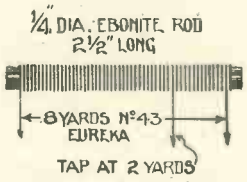
How Reaction Is Obtained

Reaction is obtained by the connection of a small capacity, provided by a Gambrell Neutrovernia, from the anode of the detector valve back to the first grid. The remainder of the high-frequency current is by-passed through a condenser running from the anode to earth. This condenser is about .0003-microfarad, but is made adjustable, a .0005-microfarad Formo-densor being used for the purpose, since its value has some effect on the reaction control. It is adjusted, when the receiver is complete, until the Neutrovernia gives reaction over the full range without any trouble.



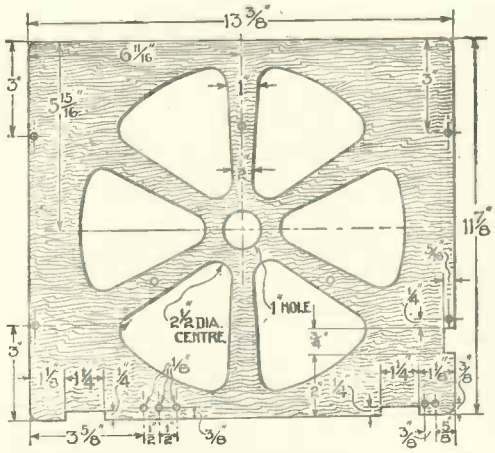
Another view of the receiver unit of the SunshineFive

This receiver has only one tuning control and covers both upper and lower wavelength bands by means of a single switch



Details of the potentiometers

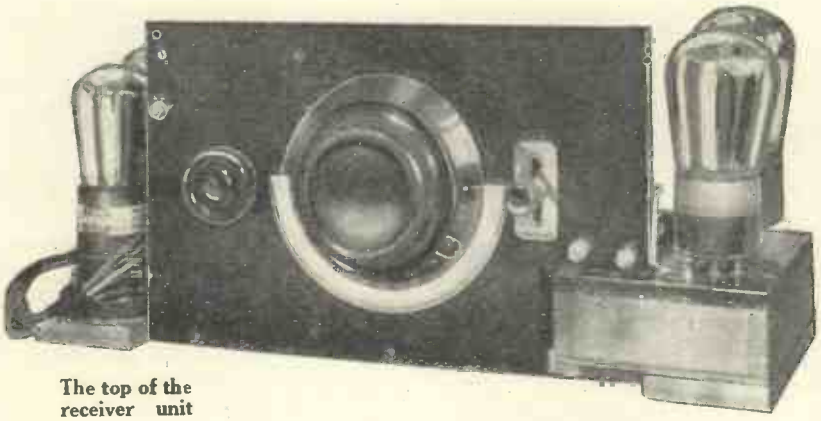
Another point of interest is that in order to obtain really smooth reaction a fixed potentiometer has been connected across the filament of the detector valve and the grid leak is taken to a point on this potentiometer. Details as to how to wind this potentiometer are given later on.



Details of cut-out front for loud-speaker in lid

A particular feature of the circuit is that the H.T. consumption is quite small, owing to the form of H.F. coupling adopted. Actually the measured consumption during the tests was a little less than 10-milliamperes, which is a reasonable value even for a small-size H.T. battery.

Since such a long period has been spent in the development of this receiver, I do not think that any reader will have difficulty in duplicating the results obtained. The vital portion of the whole receiver is the high-frequency end which is already taken care of by the use of the H.F. unit.



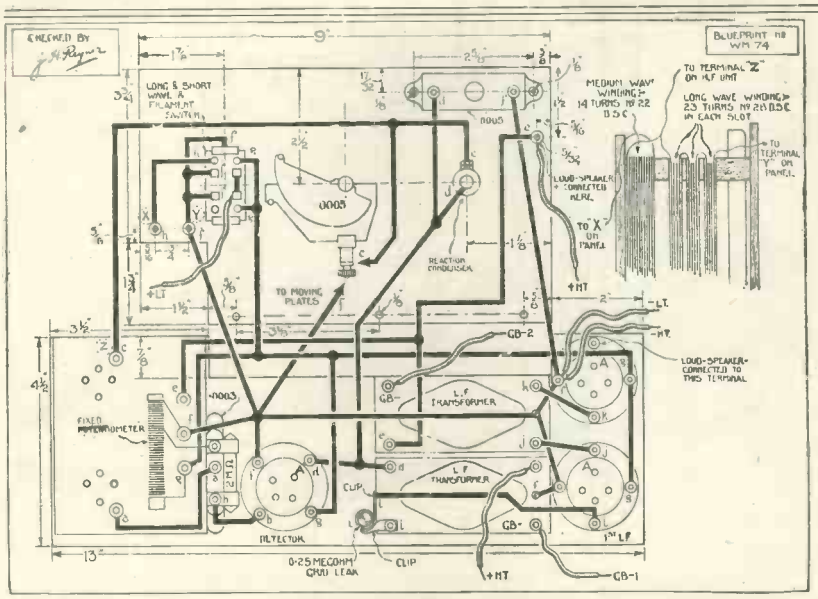
The top of the receiver unit

Use of Specified Parts

At the same time, owing to the very limited space available, it is clear that in this case the use of the specified components must be adhered to for the simple reason that, in the majority of cases, other components will occupy too much space!

Leakage of high-frequency energy through the L.F. stage is a prevalent source of trouble in portable sets and care has been taken in the present instance to avoid this. This is again another reason for the adoption of the specified layout and components, for if high-frequency

The Sunshine Five (Continued)



This layout and wiring diagram can be obtained as a full-size blueprint for half-price, that is 9d. post free, if the coupon on page iii of the cover is used before May 31

Test Report on Sunshine Five

Station.	*Wave-length in Metres.*	*Dial Reading.*
Newcastle ...	... 312.5	27
London ...	... 361.4	43*
Stuttgart ...	... 380	50
Hamburg ...	... 396	54
Langenberg ...	... 470	74
Daventry Junior	... 491.8	85*
Hilversum ...	... 1,069	28*
Kalundborg ...	... 1,154	36.5
Koenigswusterhausen	1,250	47*
Moscow ...	... 1,450	67.5
Daventry ...	... 1,604	75*
Radio Paris ...	... 1,750	86*

* Daylight Reception.

currents are allowed into the L.F. stages, trouble will arise due to whistling and such-like causes.

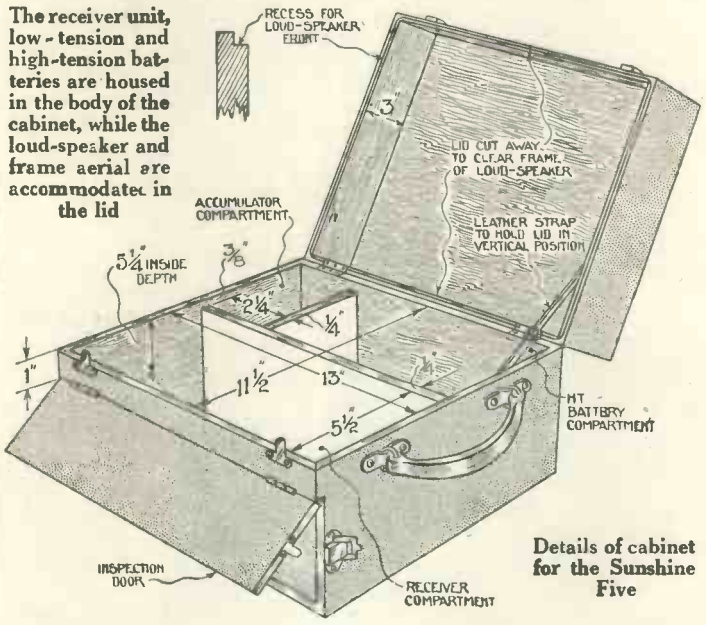
With these few general comments we can pass to the details of the actual construction.

Cabinet

The principal feature, of course, is the cabinet, and complete details of this are given herewith. The cabinet actually used for my model was supplied by the Carrington Manufacturing Co., and was finished in oak. The main body of the cabinet contains the batteries and the set itself, while the lid contains the loud-speaker and the frame aerial.

The batteries allowed for are an Oldham type SMV4 unspillable 2-volt accumulator and a Ripault 100-volt battery. The actual size allows of the use of a Lissen battery, which is slightly larger than the usual small dry battery, so that almost any make can be employed. The use of a battery having grid-bias tappings incorporated is convenient in a case of this sort, but there is ample space for an additional grid-bias battery if the operator so desires.

The receiver unit, low-tension and high-tension batteries are housed in the body of the cabinet, while the loud-speaker and frame aerial are accommodated in the lid



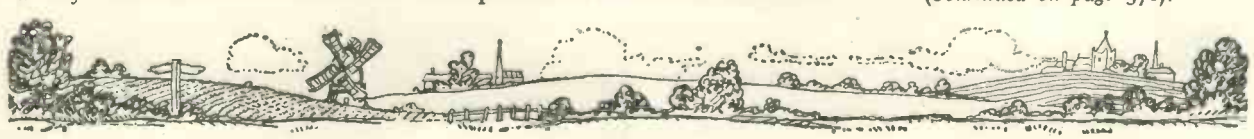
Details of cabinet for the Sunshine Five

The loud-speaker is an important component, and in this instance I have used a cone loud-speaker supplied by the Electron Company (makers of Six-Sixty valves). This is made up as a complete unit, ready for fixing behind the grille, so that no further difficulty is experienced.

Home-made Unit

Any reader who wishes to utilise his own unit and make up a cone of some sort can, of course, do so if he desires, but this particular unit is most sensitive and of pleasing reproduction, a fact which contributes materially to the performance of the receiver.

(*Continued on page* 376).



What a Little-known Pioneer of Radio Accomplished: Life and Work of Dr. Mahlon Loomi

THIRTY YEARS BEFORE MARCONI?

By FRANCIS J. MOTT

FOREWORD

NO idea is ever completely new and no single effort of man is completely detached from the work of others. Thus to attempt to apportion the praise for the "invention" of even elementary radio would probably eventually bring us face to face with the necessity of including in our roll of honour many hundreds or even thousands of names whose owners' connection with radio is extremely remote, although vital.

The thoughts of man, wandering amidst the amazing phenomena by which he is surrounded, have been focussed upon the particular phenomena connected with the transmission and detection of electro-magnetic waves by the genius of Branly, Hertz, Lodge, Marconi and many others.

But to claim for these great scientists more than they have accomplished or to allow the true perspective of their accomplishments to be lost would tend rather to diminish the historic value of their life-work than otherwise.

This somewhat lengthy preamble has as its raison d'etre the desire on the writer's part to allay any suspicions as to his object in setting forth the following history of a pioneer of radio science.

I have no reason, nor any desire, to set up claims, or to support the claims of others who for any purpose might wish to make unfounded claims, nor would I wish, even if I could (and it would be sheer egotism to believe that I could), undermine the reputations of those who have given their best for the science of radio.

Some few weeks ago I mentioned the subject of the following article to a man of very high standing in the British radio world. His comment was to the effect that he considered the whole affair "just another instance of America wishing to claim priority in another field for herself."

Such an accusation is not only unmerited, but it is entirely disproven by the records I have seen of Dr. Loomis's early struggles. These records, in fact, prove that Americans of half a century ago were but little more open to the acceptance of brand new ideas than their British cousins are sometimes accused of being even to-day.

PERSONAL NOTE

Whilst living in Washington, D.C., some little time ago, I was fortunate enough to meet Dr. J. Harris Rogers, of Hyattsville, Md., who is well known in radio circles as the inventor of a system for the subterranean and submarine transmission and reception of electro-magnetic waves.

The venerable inventor was kind enough to allow me to inspect his underground antennæ consisting of cast-iron pipes radiating from a central point and containing, though insulated from them, the actual antennæ wires.

Dr. Rogers chanced to mention that his attention was first drawn to the possibilities of radio communication by a Washington dentist, Dr. Mahlon Loomis, whom he had met whilst Loomis was engaged on his experiments.

Dr. Rogers candidly admitted to me that Loomis gave him his first ideas as to underground and underwater wireless communication. In fact, he has written as follows :—

"It was my pleasure to know Dr. Loomis in the early days when he was trying to convince a sceptical world of his new and wonderful discovery. So impressed was I, that I went to Professor Joseph Henry, then at the Smithsonian Institution, and unfolded to him Dr. Loomis's plans. Professor Henry was unconvinced. 'It can't be done,' he is reported to have said."*

After having heard from so eminent and so obviously sincere a person as Dr. Rogers I immediately set myself to discover as much as possible about this neglected genius, his life-work and the measure of his greatness.

The details as set forth hereunder constitute as complete a description of this remarkable personality and his activities as it is possible for me to compress from my copious notes into the space at my disposal.

(*Immortalised by the use of his name as the unit of inductance.)

DR. MAHLON LOOMIS

DOCTOR MAHLON LOOMIS was born at Oppenheim, New York, on July 21, 1826. He came of a line of stern New Englanders, whose ancestors had left the now quiet rural scenes of Braintree, Essex, some 300 years ago, when the minds of men were troubled with religious persecution and political oppression.

Whilst still a young man, Loomis moved to Virginia with his family, and shortly afterwards commenced to study dentistry in Cleveland, Ohio.

School Teacher and Dentist

He afterwards became a school teacher in the same State, and during the holidays often made fifty dollars a month by travelling the neighbourhood in the capacity of an itinerant dentist. Later he practised dentistry in Philadelphia and at Cambridge, Massachusetts. Even whilst engaged in the prosaic calling of a dentist the inventor in him came uppermost, for on May 2, 1854, he obtained a patent for false teeth, consisting of a gutta-percha plate with the teeth embedded. Loomis also obtained a British patent.

In 1856 Loomis married and shortly afterwards went to live in the American Federal capital.

It is not improbable that the Loomis finances were often in a sad way, as his extremely inventive turn of mind continually led him into experimental undertakings which were by no means cheap to finance. Among his experiments may be mentioned an attempt to improve horticulture by burying electric wires in his garden, thus keeping the soil to an even temperature (an experimnet which has been repeated by others on a large scale in recent years); also the construction of balloons with heavy coatings of gold paint devised to collect electricity from the upper atmosphere.

It is thought that the greater part of his earnings from the dental profession were allocated to the financing of these and similar schemes.

Messages Without Wires in 1865!

At what juncture Loomis first bethought him of the possibilities of radio communication it is not easy to discover, although it is certain that

in 1865 he sent intelligible messages between Mounts Cochoctin and Beorse Deer in Virginia—a distance of about fourteen miles—without the use of interconnecting wires.

In these early experiments he employed no "artificial" power, but collected the required energy from the upper strata of the atmosphere by

Thirty Years Before Marconi? (Continued)

UNITED STATES PATENT OFFICE.

MAHLON LOOMIS, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN TELEGRAPHING

Specification forming part of Letters Patent No. 129,971, dated July 30, 1872.

To all whom it may concern:

Be it known that I, MAHLON LOOMIS, dentist, of Washington, District of Columbia, have invented or discovered a new and improved Mode of Telegraphing and of Generating Light, Heat, and Motive-Power; and I do hereby declare that the following is a full description thereof.

The nature of my invention or discovery consists, in general terms, of utilizing natural electricity and establishing an electrical current or circuit for telegraphic and other purposes without the aid of wires, artificial batteries, or cables to form such electrical circuit, and yet communicate from one continent of the globe to another.

To enable others skilled in electrical science to make use of my discovery, I will proceed to describe the arrangements and mode of operation.

As in dispensing with the double wire, (which was first used in telegraphing,) and making use of but one, substituting the earth instead of a wire to form one-half the circuit, so I now dispense with both wires, using the earth as one-half the circuit and the continuous electrical element far above the earth's surface for the other part of the circuit. I also dispense with all artificial batteries, but use the free electricity of the atmosphere, co-operating with that of the earth, to supply the electrical dynamic force or current for telegraphing and for other useful purposes, such as light, heat, and motive power.

As atmospheric electricity is found more and more abundant when moisture, clouds, heated currents of air, and other dissipating influences are left below and a greater altitude attained, my plan is to seek as high an elevation as practicable on the tops of high mountains, and thus penetrate or establish electrical connection with the atmospheric stratum or ocean overlying local disturbances. Upon these mountain-tops I erect suitable towers and apparatus to attract the electricity, or, in other words, to disturb the electrical equilibrium, and thus obtain a current of electricity, or shocks or pulsations, which traverse or disturb the positive electrical body of the atmosphere above and between two given points by communicating it to the negative electrical body in the earth below, to form the electrical circuit.

I deem it expedient to use an insulated wire or conductor as forming a part of the local apparatus and for conducting the electricity down to the foot of the mountain, or as far away as may be convenient for a telegraph-office, or to utilize it for other purposes.

I do not claim any new key-board nor any new alphabet or signals; I do not claim any new register or recording instrument; but

What I claim as my invention or discovery, and desire to secure by Letters Patent, is—

The utilization of natural electricity from elevated points by connecting the opposite polarity of the celestial and terrestrial bodies of electricity at different points by suitable conductors, and, for telegraphic purposes, relying upon the disturbance produced in the two electro-opposite bodies (of the earth and atmosphere) by an interruption of the continuity of one of the conductors from the electrical body being indicated upon its opposite or corresponding terminus, and thus producing a circuit or communication between the two without an artificial battery or the further use of wires or cables to connect the co-operating stations.

MAHLON LOOMIS.

Witnesses:
BOYD ELIOT,
C. C. WILSON.

Reproduction of Dr. Mahlon Loomis's Patent Specification

means of kites. He used antennæ both rigid and suspended from kites—and about this time he also sent messages between two ships in Chesapeake Bay by means of an underwater system in which he employed two wires of varying lengths.

Confirmation

At this juncture it might be interesting to note that Doctor J. Harris Rogers, who developed a successful subterranean system of radio, has also found that results were not forthcoming unless the antennæ leads used were of different lengths.

Before passing into a more detailed discussion of Loomis's experiments and the apparatus used therein it might be of interest to review briefly the theories which both led him to experiment and those which he subsequently deduced therefrom.

In referring to the use of kites as a means for obtaining energy for the operation of his transmitter, Loomis wrote as follows:

> The upper strata is a great electrical sea . . .

and also:

> Franklin certainly did draw down electric fluid from the clouds; why not make another draft? By the perfection of appliances there is no doubt in my mind that a constant and never failing current may be obtained powerful enough to telegraph across the ocean . . and to this end I wish to write down some facts and ideas, hoping to add more and go further until successful experiments are made and the reality of this dream come to pass.

One of the sketches reproduced on page 301 (drawn by the WIRELESS MAGAZINE from copies of Loomis's originals) show clearly the "electrical sea" which Loomis accepted as being the condition of the upper atmosphere, and it is interesting to note that this theory does in some respects foreshadow the now generally accepted theory of Oliver Heaviside, and though perhaps we are wont to regard the Heaviside layer as a screen of ionised atmosphere rather than as a "sea of electricity" the semblance is none the less striking.

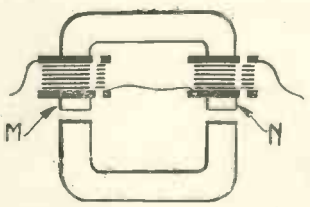
Doubts Expressed

Scientific men to whom I have shown the drawings reproduced here have expressed some doubt as to the validity of Loomis's theories. That he achieved something in a rather blind and empirical fashion they do not doubt—in fact they cannot do so.

But they point out that whereas Hertz and Marconi knew what they were about and had a certain grasp of the *laws* with which they were dealing, thus enabling them to experiment intelligently, Loomis, in common with others (Hughes, for example), was a blind stumbler in the dark; brilliant no doubt, but unable to offer a tangible basis upon which a *science could be built*.

Mistaken Impression

To back up this sweeping assertion they point out that some of Loomis's sketches reveal him as under the mistaken impression that what he was doing was to achieve electrical contact with a conducting layer in the upper atmosphere and simply passing electrical impulses through this medium between these two points.



Form of magnetic detector used by Loomis

This, they aver, is an entirely misleading concept of affairs likely to retard progress rather than to aid it by the fact that it sets a false scent.

That this is not wholly the case is clear from the wording of a bill which was introduced into Congress

An American's "Radio" Experiments in 1865!

in the year 1872. In this bill Loomis's theory was presented as follows:

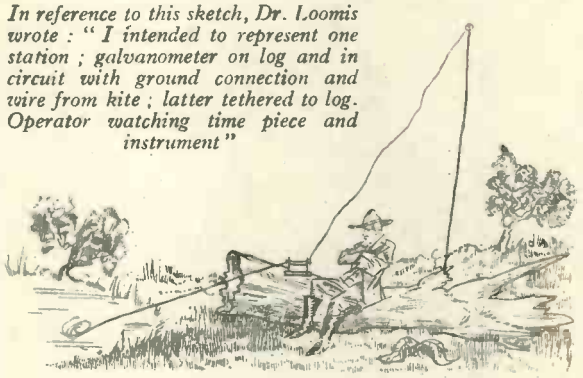
This theory assumes that the earth itself, the atmosphere surrounding it, and the infinite depths of space encompassing this aerial world, contains a succession of concentric circles or planes of electricity of which those nearest the earth are perpetually disturbed by oceanic currents, atmospheric changes, alterations of day and night, and the ever-varying effects of solar radiation and lunar influences; but that above those pierced perhaps by the loftiest mountains, are concentric circles, or vast surrounding seas of undisturbed electricity, which may be affected by any interpenetrating galvanic force from beneath, causing electrical vibrations, *or waves, to pass from that point* within such electric plane around the world, *as upon the surface of some quiet lake one wave circlet follows another from the point of disturbance to the remotest shores, so that from any other mountain top upon the globe any conductor which shall pierce this plane and receive the impressed vibration may be connected to an indicator, which will mark the length and duration of such vibration.*

Senatore Marconi—

—took out his first radio patent in 1896

Germ of Wave Theory

It will be seen that Loomis certainly had the germ of the idea of electromagnetic wave propagation as later outlined by Hertz. For the time being, however, he unnecessarily limited their radiation to certain planes—a limitation which was missing from the Hertzian theory. Undoubtedly this limitation would have disappeared had he received sufficient support to enable him to continue his experiments — but speculation is not the object of this article.



In reference to this sketch, Dr. Loomis wrote: "I intended to represent one station; galvanometer on log and in circuit with ground connection and wire from kite; latter tethered to log. Operator watching time piece and instrument"

But even though Loomis had not been able to escape from the concept of an "electrical sea" in the upper strata which was necessary for the propagation of electromagnetic waves yet he must necessarily have employed radio waves as we know them to-day, for what else could he have used?

The inventor found that he was lacking in sufficient funds to enable him to do justice to his idea, and he made efforts to obtain financial backing. In 1872 the Loomis Aerial Telegraph Bill passed through Congress and carried with it an appropriation of 50,000 dollars, but this sum never reached the inventor, owing to the unfortunate omission from the bill of any mention as to the source from which the money was to be obtained.

First U.S. Wireless Patent

In the same year Loomis secured the first patent ever issued in the United States to cover a system of wireless telegraphy.

A year later the first wireless telegraph company was formed in Washington, D.C., but the terrible financial collapse which followed the Civil War and which culminated in the famous "Black Friday" brought the company's backers to grief.

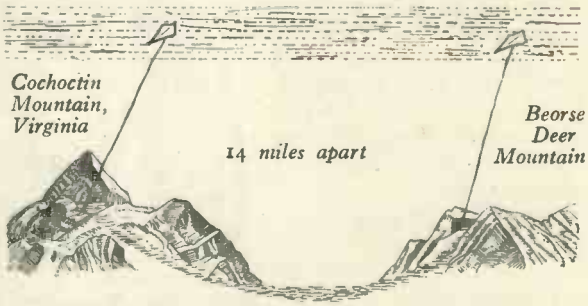
Yet another venture was attempted into the realms of finance, but once again a cruel fate intervened. This time the backers were Chicago men and the calamity which ruined them was the terrible Chicago fire which did much damage.

Under these disappointments Loomis began to weary and to despair, but before we pass to his final relinquishment of all hope of fulfilling his plans, let us examine for a moment the apparatus used by him.

Apparatus Loomis Used

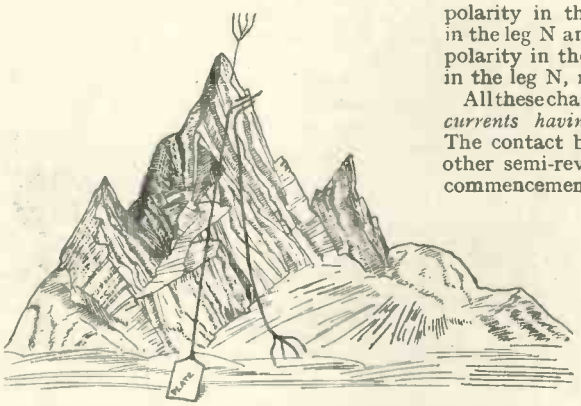
Details of these are not by any means copious, but his sketches clearly indicate that Loomis used aerial, aerial inductance and earth in much the same way as at present. Artificial capacity, however, seems to be missing from the system. Another sketch indicates that the inventor used a form of magnetic detector during his experiments, but the exact form of this is not certain. That Loomis possessed some such instrument is, however, further deduced from a scanty note and rough sketch which appear together in his diary:

It has been stated that if the extremities of the wire were not in metallic contact with each other, or with a continuous system of conductors these inductive currents would not be produced . . . This condition supplies the means of producing in the



"Sent signals by 'aerial telegraph' between these two stations by elevating a kite on each mountain, the string of which was a small copper wire, attached to galvanometer, each ground line lying in water. The signals perfect during the cloudy part of the day. Elevation about fifteen hundred feet"

Thirty Years Before Marconi ? (*continued*)



"*It must not be the primary electricity as we find it in the atmosphere that must be used, but modified, or a* secondary *current used.*"—DR. MAHLON LOOMIS, 1867.

wire *an intermitting inductive current constantly in the same direction.*

To accomplish this, it will be necessary to contrive means to break the contact of either extremity of the coil with the intermediate conductor during the same half of each successive *revolution of the magnet.*

By this expedient the contact may be maintained during the half revolution in which the commencement of austral polarity in the leg M and of boreal in the leg N and the cessation of boreal polarity in the Leg M, and of austral in the leg N, respectively, takes place.

All these changes produce momentary *currents having a common direction.* The contact being broken during the other semi-revolution, in which the commencement of boreal polarity in M, and of austral in N, and the cessation of austral polarity in M and of boreal in N, respectively takes place, that contrary currents which would otherwise attend these changes will be produced.

Unfortunately for those who would make a more exhaustive survey of this pioneer's work, certain of his notes and models (what they were is not exactly known) were destroyed by a fire which occurred at the United States Patent Office in Washington.

The end of Mahlon Loomis was similar to that suffered by many a pioneer. He died, literally of a broken heart, in 1886, at the home of his brother in West Virginia.

Deserted by his friends, even by his wife, in his hour of need; abandoned by Congress; mocked and derided by a certain section of the Press, the inventor had yet the faith to say as the end approached:

> If the present generation lives long enough their opinions will be changed, and their wonder will be that they did not see it before. I shall never see it perfected, but it will be, and others will have the honour of the discovery . . . the Congressional records will furnish. The indisputable proof that the credit belongs to me.

Continental "Radioed" English

LAST week I hunted up all the Continental stations that gave lessons in the English language and the result was a real revelation as to the manner in which these foreign stations treat it.

Some of the stations were at the beginning of a course, others were trying to unravel our intricate syntax to listeners who must have thought unkind things about the "language of exceptions." Two stations were reading our classics and giving comments thereon.

English as she is spoken from these stations has an accent that is foreign to our own country, although in one instance the accent resembled that of Dorsetshire. However, when compared with other languages, English seems to be the favourite and if the supply is in response to a demand, many thousands are keen learners of our tongue.

French is taught from two Continental stations; German from two; and Italian from one. The B.B.C. stations give talks on French, German and other languages occasionally, but there is no comparison in the amount of time put in by foreign languages in this country to that which English gets on the Continent.

The new country of Czecho-Slovakia from its station at Bruenn (Komarov, 443 metres) gives a good elementary lesson in English on Monday evenings. The teacher is an exceptionally good linguist and gets all his points home well, and thoroughly. The course is continued on Tuesdays and Fridays.

From Berlin

A very fine English lesson is given from Berlin (Koenigswusterhausen) on Tuesdays in the evening and also on Fridays. Besides this many of the other German stations give readings from the English classics weekly. Frankfurt-on-Main besides having a good course on English grammar has also a series of readings. At present the text-book is *Ivanhoe* and it is done thoroughly.

E. B. R.

Build the Sunshine Five!

Here is a happy party enjoying a programme from Daventry. *Read all about the set on page 294.*

HALYARD'S Chat on the Month's Topics **Sketches by GLOSSOP**

Controversy

WE seem to have made a little progress at last in the controversy about controversy, but I, for one, am not wildly excited about it, are you?

As you are aware, the Governors of the B.B.C. are now permitted to broadcast controversial matter at their discretion, on the understanding, I suppose, that a fair balance will always be maintained between the various interests involved.

It is expected that this lifting of the ban on controversy will not mean

Controversy

an encroachment on the time allotted to music and other forms of entertainment, but that studio and outside debates will take the place of some of the educational and other talks to which we have become more or less accustomed, according to our desire, or lack of desire, for the uplifting influence.

What kind of controversial topics will be chosen for broadcasting, do you think? I have only seen one topic mentioned, or perhaps I ought to say anticipated, so far, and that was a religious topic. Political topics will, of course, be much to the front.

One suggestion I should like to make with regard to these broadcast controversies is that a wireless subject should be chosen occasionally. For example, wireless and weather would make a fine subject for debate, especially if one side of the question were debated from Matlock, don't you think?

◆ ◆ ◆

Fool-proof Sets

The Chief Engineer of the B.B.C. has expressed the opinion that the future of listening is in terms of fool-proof sets, and that the problem of reception should be made as simple as possible.

Now it is all very well to make a wireless receiving set as simple as possible, but I am rather inclined to think that this simplification business can be carried a little too far. Let me give you an actual example of what I mean.

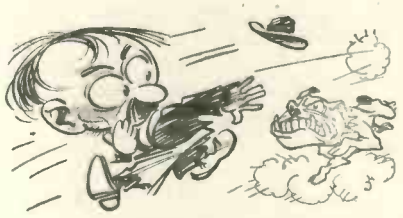
One evening last week I accepted the invitation of a new friend of mine to go and hear his wireless set. The set was a three-valve receiver, detector valve followed by two low-frequency amplifying valves, transformer-coupled. There were the usual tuning and reaction controls on the panel, but the three valves were controlled by fixed resistors and one simple push-pull switch to switch the three valves on or off simultaneously.

My new friend had had the set just long enough for him to feel the desire to reach out and bring in the more distant British stations and the Continental stations. With his set as it was, however, he found that he could not get more than five or six British stations, including the two Daventries. I tried my hand, but I could do no better.

The simplicity of the set was all very well and useful up to a point, but as soon as ever the operator wished to make some progress in wireless listening he was severely handicapped by that simplicity. What was needed more than anything else on that particular set was separate and adjustable filament control for each valve.

I asked George for his ideas about fool-proof receiving sets, and his reply was typical of him. He said:

"There would be no fire-proof safes if there were no fire. There would be no rain-proof coats if there were no



Fool-proof Sets

rain, and there would be no fool-proof wireless sets if there were——"

◆ ◆ ◆

Lookers-in?

What is the truth about television? There seems to be a good many vague and contradictory statements going about just now with regard to this fascinating science.

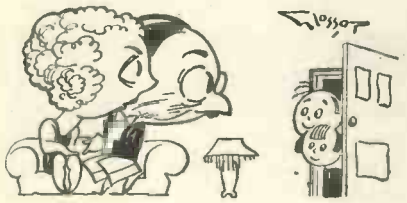
One authority asserts that television will never be practicable until some entirely new principle is evolved. A great inventor tells us that television is remarkable, but hardly applicable for general use. Another authority informs us that television has come out of the laboratory at last and that television is about to enter our homes, just as broadcasting

Tell Your Friends About the Crusader—on Page 322

Under My Aerial (*Continued*)

did a few years ago. Between these and other conflicting statements the question is, where are we?

The most optimistic of the television prophets tell us that we shall all be building television receivers before 1928 is out. Wonderful, isn't



Lookers-in

it; too wonderful to be true, perhaps?

Suppose we are all using television receivers by the end of the year. What shall we call ourselves? Shall we adopt the term "looker-in," in the same way that we adopted the term "listener-in" a time back? If so, I wonder whether the term will ultimately be reduced to plain "looker," just as "listener-in" has become reduced to "listener."

Here's a question for you. When television becomes an accomplished fact, will the broadcast looker look at the broadcast listener and will the broadcast listener listen to the broadcast looker?

◆ ◆ ◆

A Super Loud-speaker

"The Bell Telephone Company, of America, has put on the market a new loud-speaker so powerful as to be heard a mile away," I said to George during a recent technical discussion on loud-speakers.

"Fine chance for somebody to invent a protective ear filter," remarked George thoughtfully.

"Listen to this, George. It is calculated that a million people can be spoken to at the same time by this huge loud-speaker."

"Suppose some of the million object to being spoken to? What's going to happen then? Is the Bell Company in the market with a specially constructed, portable, soundproof cellar?"

"No idea, George. Continuing our discussion on giant loud-speakers, it has already been hinted that further developments may lead to the building of a monster loud-speaker with a range sufficiently great for it to be heard across the Atlantic Ocean. Just imagine that now. News broadcast in New York would be heard here in England. Wonderful!"

"What is the distance from New York to England?"

"Oh! er—a matter of three thousand miles or so."

"And the speed of sound waves?"

"Eleven hundred feet per second."

"In miles per hour?"

"Seven hundred and fifty, near enough."

"Three thousand divided by seven hundred and fifty?"

"Four."

"The idea is no good, then. They will never build such a loud-speaker."

"Why, George?"

"Because it would take four hours for the sound waves to travel from New York to England. The news

A Super Loud-speaker

would be old by that time. Wireless waves travel the same distance practically instantaneously. They'd use wireless, every time, because it's heaps quicker."

◆ ◆ ◆

Sunday Programmes

What do you think of our Sunday broadcast programmes? Do they meet with your approval as they are now constituted, or would you suggest alterations in them?

Sunday Programmes

B.B.C. officials in London have reason to believe that the number of listeners who listen to the Sunday afternoon wireless concerts is much smaller than it used to be. Have you any guilty feeling with regard to these Sunday afternoon concerts? Do you neglect to make use of them? I am afraid I am guilty of such neglect, the reason being, in my case, a liking for a stroll in the country on a Sunday afternoon and not, as in some cases, a liking for forty winks after a Sunday dinner.

What is your feeling in the matter of the religious service broadcast on Sunday evening? Would you prefer this service to be broadcast earlier in the evening than at present, or do you think that this broadcast service should not be allowed to encroach on the usual hours of church service? There are advantages in the earlier service, perhaps, in that there would be a greater choice of services which could be actually relayed from a place of worship.

To invalids, to elderly folk, and to others who cannot leave their house on a Sunday evening, one of the great charms of listening to a service broadcast from a place of worship is that the listener is taking part in a service in which others are taking part.

Perhaps it is because of this that many listeners continue to press for the earlier service.

◆ ◆ ◆

Village Aerials

Last week-end I visited a small country village situated at least four miles from the nearest railway station. I did not expect to see much evidence of wireless in this village, but, on walking the length of the village street, I was surprised to see quite a large number of aerials.

Some of these village aerials looked thoroughly efficient, but there was a preponderance of two types which seemed to me to warrant strong disapproval. The first of these two types was a single-wire aerial which, at the house end, was brought to within a foot or so of a chimney. The down-lead came down parallel to the sloping roof, and just above that roof, to an insulator placed on a horizontal bracket which projected out horizontally at the lower edge of the roof.

From this insulator the down-lead was taken to the leading-in tube in the usual way. The aerial wire was thus divided into three parts, the horizontal part from mast to chimney, the sloping part from chimney to edge of roof, and a nearly vertical part

Halyard's Chat on the Month's Topics

from edge of roof to leading-in tube.

It was the part of the aerial passing over the sloping roof which I did not like. An aerial taking the form of a true inverted L, with the usual two parts, horizontal and vertical, would have been much better in my opinion.

Last Week-end

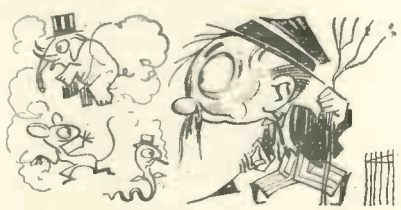
The necessary change could easily have been made by letting out the chimney insulator on a wire or rope long enough for the insulator to clear the roof.

The second type of aerial I took objection to in this remote village was a twin-wire aerial placed above and parallel to the ridge of a roof.

◆ ◆ ◆

A Strange Theory

Perhaps by this time you may have seen or heard several of the migrant birds which return to your district



You May Have Seen . . . .

for the summer months—the swallow, the corncrake, and the cuckoo, for example.

Have you ever heard or read of any theory that explains the migratory instinct and sense of direction possessed by these migrant birds? The latest of such theories is a very strange one, and, like a good many of the fanciful theories of the present day, this strange theory has wireless as its basis.

Briefly, this new theory is that a bird has a short-wave transmitter and receiver in its brain, and that, in flying long distances, the bird makes use of wireless waves without knowing it.

I am afraid that I cannot quite get the hang of this theory, can you? If a bird sends out wireless signals, it must send those signals out to some other bird. What other bird does it signal to? If a bird receives signals, it must receive those signals from some other bird. What other bird signals to it? There seems to be little use in birds signalling to each other when in flight and within sight of each other.

Another bothering thing about this theory is that, if it applies to birds, it may apply to other living creatures, butterflies, for example. You know that butterflies fly long distances and find their destination in some extraordinary fashion.

Then again, we might expect the theory to apply to the dog which finds its way back to its old home over thirty miles of country.

I would like to know what you think of this theory.

◆ ◆ ◆

There and Back

"George, you remember explaining to me how it was that the loud-speaker was more popular than the phones in America?" I asked my technical adviser last Thursday night.

"Nope," replied George.

"But you ought to remember such things, George."

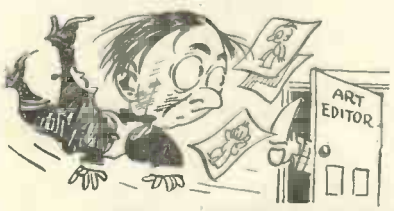
"If I remembered all I said to you, Mr. Halyard, I should be able to write a book on wireless. What was the explanation I gave you on this important matter?"

"Well, George, you said the reason why the loud-speaker was preferred to the headphones in America was that you can't wear phones comfortably and chew gum at the same time."

"A jolly good reason, too. What's wrong with it?"

"Nothing at all, George. The interesting thing about your explanation is that an American wireless periodical copied it."

"Very nice of them, shows their good taste, but there's nothing unusual about that, is there?"



There and Back

"No, George, but I've not finished, yet. This morning I picked up one of our weekly wireless papers and I found your ingenious explanation repeated there. The funny thing was that this weekly paper had not copied your explanation from my original version in 'Under My Aerial,' but from the American magazine. So your little joke travelled to America and back, old man."

"Pretty live joke to do that, wasn't it? It gives you a good idea as to how far a joke will carry in these days of rapid transit."

◆ ◆ ◆

Loud-speakers

Do you ever read wireless articles in the non-wireless papers? It is not often that I do so, but just lately I

"Loud"-speakers

happen to have seen a number of such articles dealing with loud-speakers.

In one of these articles I read that the horn type of loud-speaker was rapidly becoming extinct, and that there was no wonder about this, since any cheap loud-speaker of the cone type was superior to most expensive loud-speakers of the horn type.

What do you think of that now? Do you agree or not? It all depends on the kind of loud-speaker you happen to be used to, doesn't it?

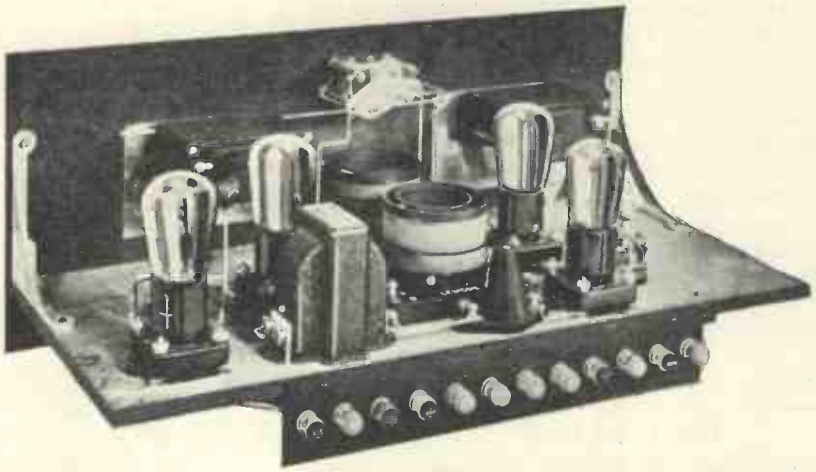
In another of these articles, I came across the very definite statement that no good loud-speaker could be had for five pounds or less. Well, if that is true, I, for one, have never had a good loud-speaker yet.

The best loud-speaker I ever had didn't cost five pounds—not quite—but it very nearly did. In fact, it came within five shillings of that amount. It is a very good loud-speaker though, and I am still very fond of it.

The test to apply to a loud-speaker is the amount of enjoyment you get out of it. What do you say about it? HALYARD.

In this article we are able to give particulars of a simple four-valver comprising a stage of high-frequency amplification, a detector, and two stages of low-frequency amplification. Both upper and lower wavelength bands are covered by a movement of a single switch on the panel—a great boon for the operator.

The Q-coil Four



One Knob Only to Change Wavelength Range of Both Aerial and Anode Tuning Circuits

Designed, Built and Tested by the "Wireless Magazine" Technical Staff

A NUMBER of articles have appeared recently in the pages of the WIRELESS MAGAZINE from the pen of our Technical Editor, J. H. Reyner, B.Sc., A.M.I.E.E., explaining a new and revolutionary type of tuning coil that is now available for amateur constructors—namely the "Q" coil.

Advantages of the "Q" Coil

Briefly, the advantages of this new coil are that by means of a simple switch incorporated in the coil itself *as manufactured* it can be made to cover both lower and upper broadcasting bands of wavelengths; it is astatic on the low-wavelength band and therefore does not pick up the local station as would an ordinary coil; and lastly, these advantages are obtained without the use of any form of metal screening.

Careful research work carried out over a period of many weeks has shown that the principle of the "Q" coil can be applied equally as well for the construction of high-frequency transformers as for aerial coils. This means that at once a great simplification in the design of multi-valve receivers is available for the home constructor and WIRELESS MAGAZINE readers will at once see how easily they can take advantage of this latest development.

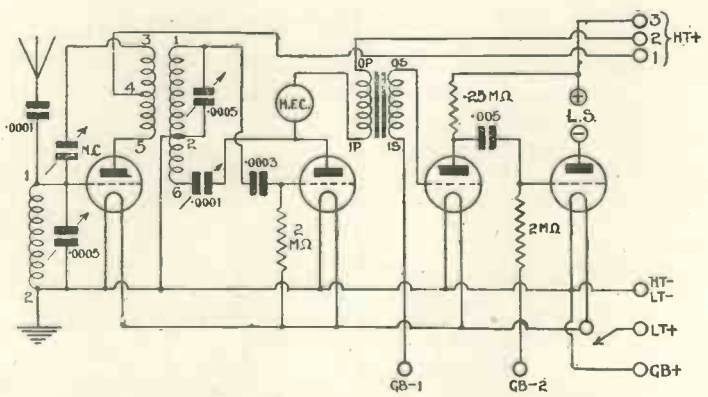
By means of an ingenious form of construction it is possible to place any number of "Q" coils in a row and arrange their switches on a common spindle; in this way the moving of one knob will change the wavelength range of all the coils at once—what a welcome boon for the operator!

Because four-valvers are particularly popular amongst a large number of listeners, the WIRELESS MAGAZINE this month gives particulars of a simple four-valve receiver making use of "Q" coils (a two-valver was described last month—see "The 'Q'-coil Two," WIRELESS MAGAZINE, April, 1928).

Straightforward Circuit

The circuit adopted is a perfectly straightforward one as can be seen from the diagram reproduced on this page. A stage of neutralised high-frequency amplification is followed by a leaky-grid detector, and two stages of low-frequency amplification—the first transformer-coupled and the last resistance-capacity coupled.

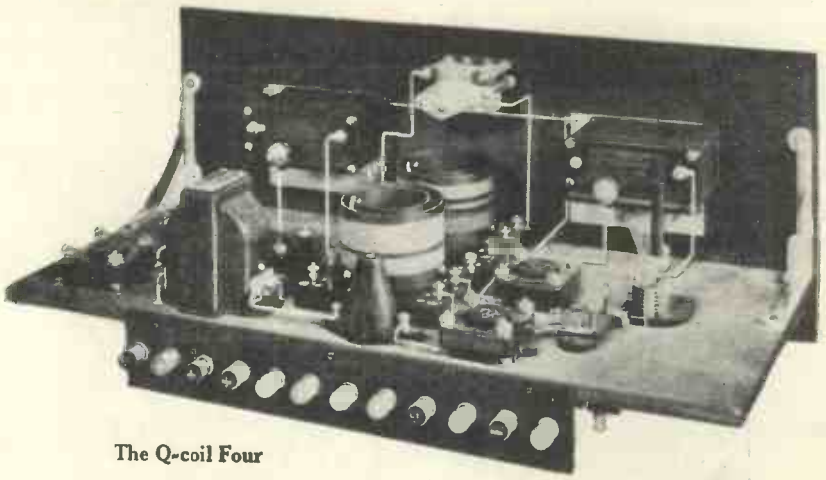
A glance at the high-frequency part of the circuit will show that the connections for the "Q" coil are exactly the same as those for the standard type of six-pin split-primary transformer, a form



Here is the circuit of the Q-coil Four. Note that the connections for the "Q" transformer are the same as those for a six-pin split primary transformer

of Reinartz reaction being obtained in the usual way.

The use of "Q" coils, however, is not the only new feature about this receiver, for a new, and what may be to some constructors, easier, method of wiring is adopted. This will be explained at greater length later in the article, but the resulting neat appearance can be judged from the photographs of the receiver reproduced in these pages.

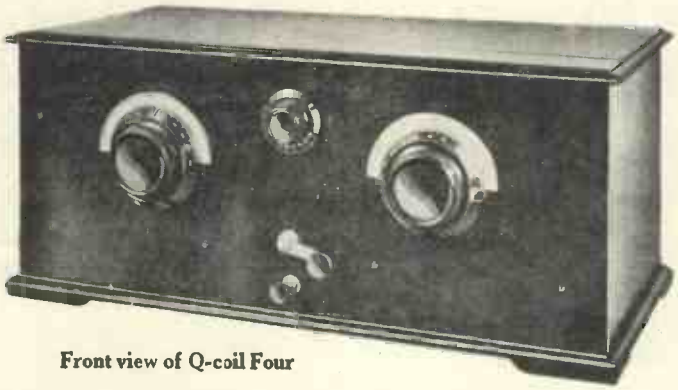


The Q-coil Four

Very Simple Controls

Just as neat is the external appearance of the Q-coil Four, which can be seen from the photograph reproduced on this page. The two large dials are respectively those for tuning the aerial and anode circuits. The small dial in the centre is the reaction control, while below that are the wavelength-range switch arm and the knob of the push-pull on-off filament switch.

A complete list of all the parts required is given on page 308 and



Front view of Q-coil Four

constructors are recommended to keep as close to the original specification as is possible. The names that appear first in the brackets are those of the manufacturers whose parts were used in the original WIRELESS MAGAZINE receiver; the other names are those of manufacturers who can supply suitable alternatives.

Full-size Blueprint

Before beginning the construction of the Q-coil Four readers are recommended to obtain a full-size blueprint drilling guide, layout and wiring diagram; this can be obtained for half-price, that is 9d. post free, if the coupon on page iii of the cover is used before May 31.

Ask for blueprint No. W.M.71 and address your enquiry to Blueprint Dept., WIRELESS MAGAZINE, 58/61 Fetter Lane, E.C.4. It should be mentioned here that although many constructors prefer to work to a full-size blueprint its use is not absolutely essential, for all the essential details are reproduced in these pages on a smaller scale.

It will be observed that the baseboard is not fixed right at the bottom of the panel, but a short distance up it, and that all the wiring of the baseboard components is carried out *underneath* the baseboard. Although this looks complicated the WIRELESS MAGAZINE has found that this method of sub-baseboard wiring can, in fact, be carried out quicker than the usual method.

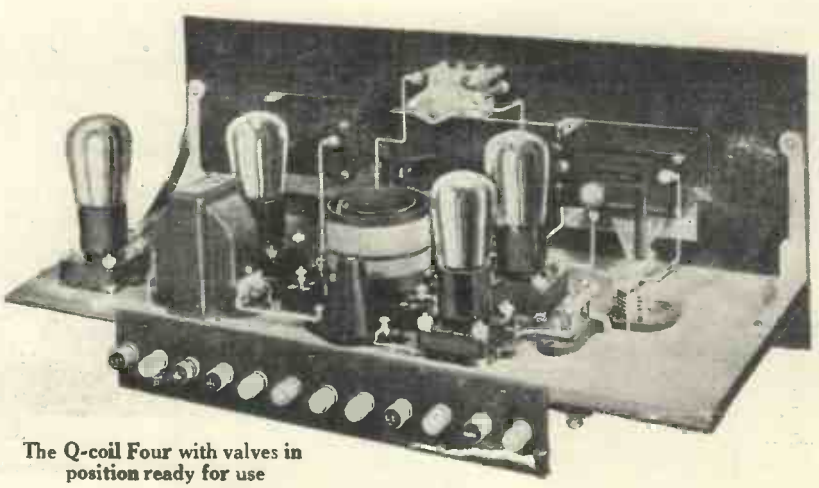
After having mounted all the components in position on the panel, the baseboard components should next be mounted *before* panel and baseboard are fixed together. Wiring up will be very much simplified if exactly the same components as used in the original set are employed by the constructor.

When the components have been mounted on both the panel and baseboard (note that the .0001-microfarad fixed condenser in the aerial lead is screwed underneath the baseboard close to the aerial terminal), these can be fixed together by means of brackets.

Positions of the "Q" Coils

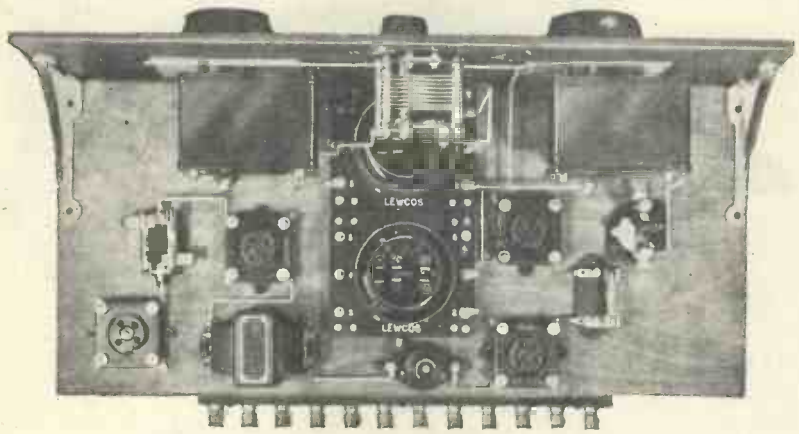
It will be seen that the "Q" coils are placed one behind the other. Underneath each base is a part of the switch which has a square hole cut in it. Through this hole is placed the square spindle which thus enables both change-over switches on the two coils to be operated at once by means of a single knob on the panel.

In the case of coils other than Lewcos it will be necessary to join the spindles together by some simple



The Q-coil Four with valves in position ready for use

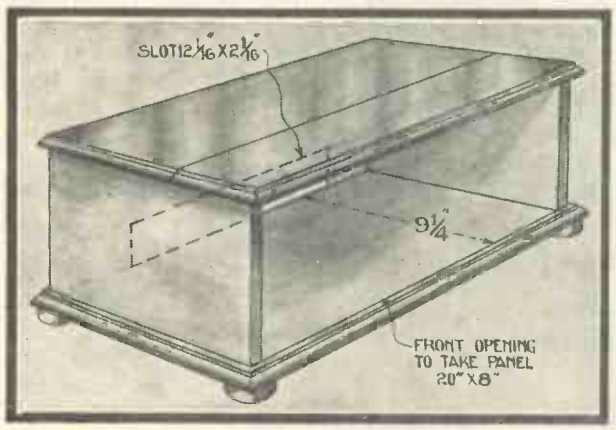
The Q-coil Four (Continued)



Plan view of the baseboard of the Q-coil Four

coupling device, such as a collar with two set-screws.

For the convenience of constructors two wiring diagrams have been prepared. The first shows the sub-baseboard wiring as it actually appears from the underneath (see diagram on page 309) and the second shows it dotted, from above. Only the first diagram has been prepared as a full-size blueprint.



Details of Cabinet for the Q-coil Four

Several Methods of Wiring

There are really three methods of wiring up this receiver and these will be explained in detail:

The *first method*, which is also the quickest, is to pick out all those terminal points marked *a* on the top part of the wiring diagram and alongside each drill a hole through the baseboard with a small twist drill. Attach a wire to each terminal point and lead it through the hole underneath the baseboard.

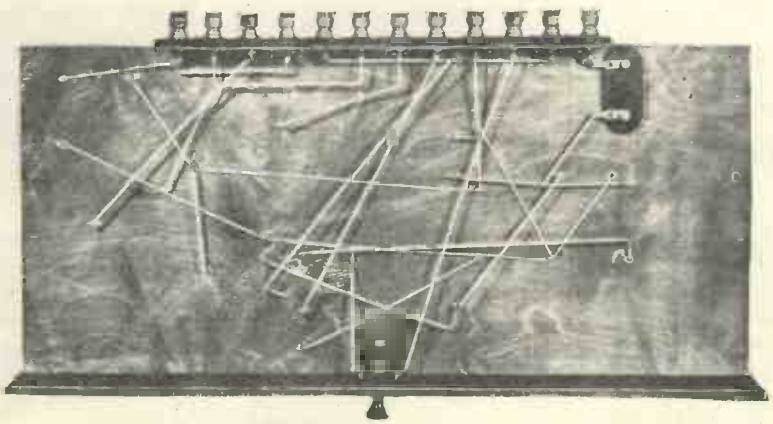
Now turn the set over and connect together in any convenient way all the wires projecting through the board. The lower half of the wiring diagram reproduced on page 309 will be a check on these connections.

Replace the receiver in its ordinary position, pick out all the terminal points marked *b*, drill holes alongside them and push wires through as before. Again turn the set over and connect together all the projecting leads. Carry on in this way throughout the alphabetical sequence to *u*.

The *second method* necessitates

Components Required

1—Ebonite panel, 20 in. by 8 in. (Becol or Will Day).
2—.0005-microfarad variable condensers, with vernier dials (Burndept, Cyldon, or Raymond).
1—.0001-microfarad variable condenser (Cyldon and Igranic).
1—Q aerial coil (Lewcos, Wearite, Atlas, or Bowyer-Lowe).
1—Q high-frequency transformer (Lewcos, Wearite, Atlas, or Bowyer-Lowe).
1—Neutralising condenser (Igranic, Wearite, or Gambrell).
4—Anti-microphonic valve-holders (Benjamin, Lotus, or W. and B.).
1—High-frequency choke (Magnum, Igranic, or Wearite).
1—Low-frequency transformer, ratio 4 to 1 (Gecophone, Mullard, or B.T.H.).
2—2-megohm resistances with clips (Loewe, Dubilier, or Mullard).
1—.25-megohm resistance with clips (Loewe, Dubilier, or Mullard).
1—.0001-microfarad fixed condenser (Edison Bell, Dubilier or Lissen).
1—.005-microfarad fixed condenser (Edison Bell, Dubilier, or Lissen).
1—Terminal strip, 12 in. by 2 in. (Becol or Will Day).
2—.0003-microfarad fixed condensers (Edison Bell, Dubilier or Lissen).
1—Pair panel brackets (Magnum).
12—Terminals, marked:—Aerial, Earth, L.T.+, L.T.−, H.T.+1, H.T.+2, H.T.+3, G.B.+, G.B.—1, G.B.—2, L.S.+, L.S.− (Belling-Lee).
1—Push-pull on-off switch (Lissen, Lotus, or Benjamin).
6—2 ft. lengths insulated wire (Glazite).
1—Cabinet, with 9 in. baseboard (Pickett's).



This view shows the sub-baseboard wiring of the Q-coil Four

Covers Both Wavelength Bands Without Changing Coils

rather more soldering, but is not quite so wasteful of wire, although that is a small item in the construction of a four-valve receiver.

Again pick out all the points marked *a* and drill holes alongside them. Now connect a *short* length of wire (½ in. to 1 in. will do in most cases) to each terminal point and push through each hole. When the baseboard is turned over, there will be projecting through it a number of points of wire; these should all be connected together with one wire or as few wires as possible, which must, of course, be soldered.

Again the lower part of the wiring diagram reproduced on this page will act as a check.

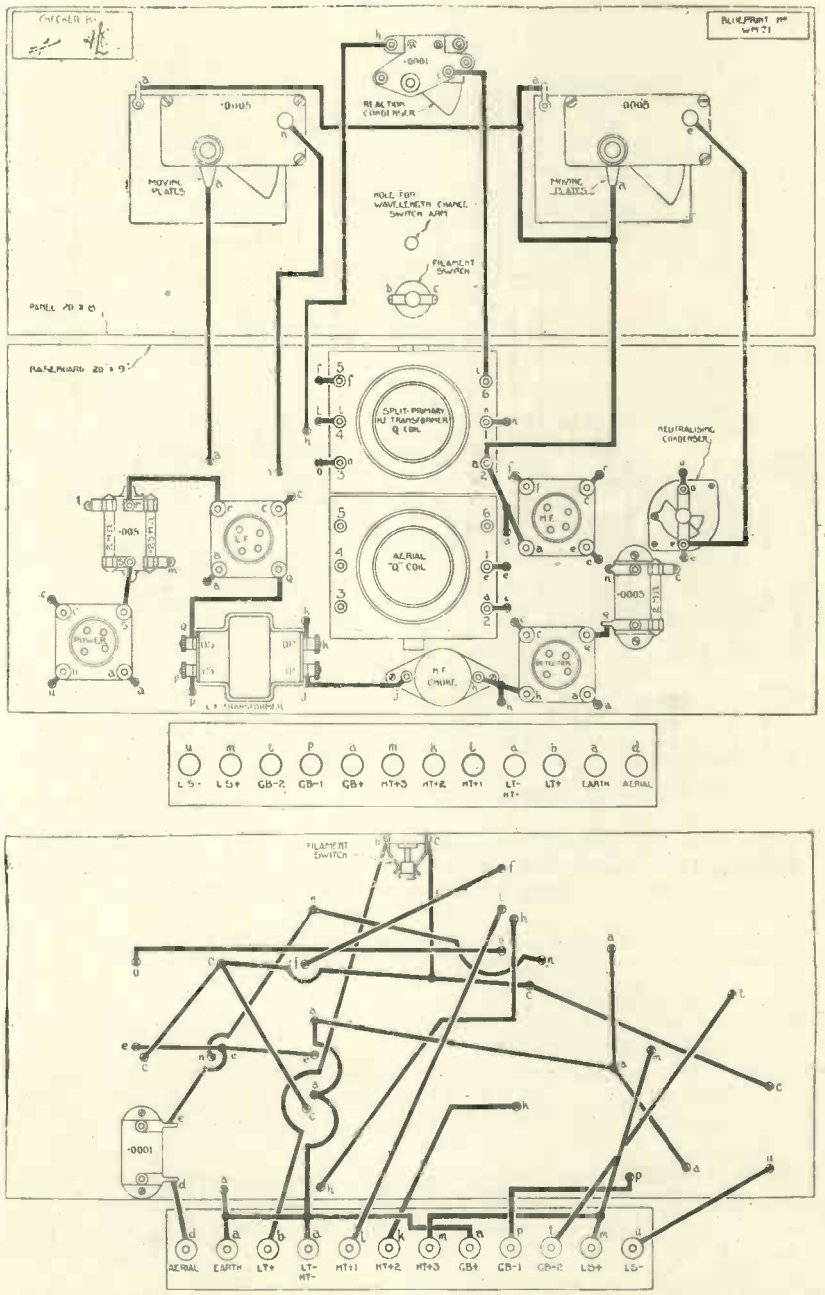
Following Connections Separately

The *third method* of wiring is on more usual lines and can only be carried out in conjunction with the diagram reproduced on page 310. Here, each connection can be followed through separately, the dotted lines indicating that part of the wiring which is carried out beneath the baseboard.

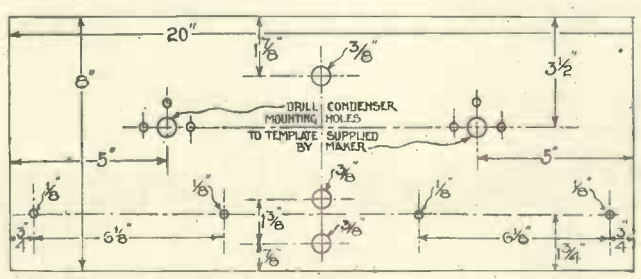
Choosing suitable valves for use in the Q-coil Four is not a difficult matter. For the high-frequency amplifier any valve with an impedance in the neighbourhood of 20,000 to 30,000 ohms is suitable. For the detector a valve of slightly lower impedance, say, 15,000 ohms, will be best.

First Low-frequency Valve

Although theoretically an impedance of round about 80,000 ohms would give the greatest amplification from the resistance-coupled stage, the third valve should preferably have a lower impedance than this; a valve with an impedance of 80,000 ohms would probably be overloaded during the reception of even moderately loud transmissions owing to lack of sufficient grid swing. A valve with an impedance in the neighbourhood of 15,000 to 25,000 ohms is therefore recommended for this stage.



This layout and wiring diagram of the Q-coil Four can be obtained as a full-size blueprint for half-price, that is 9d. post free, if the coupon on page iii of the cover is used before May 31. Ask for Blueprint No. W.M. 71.

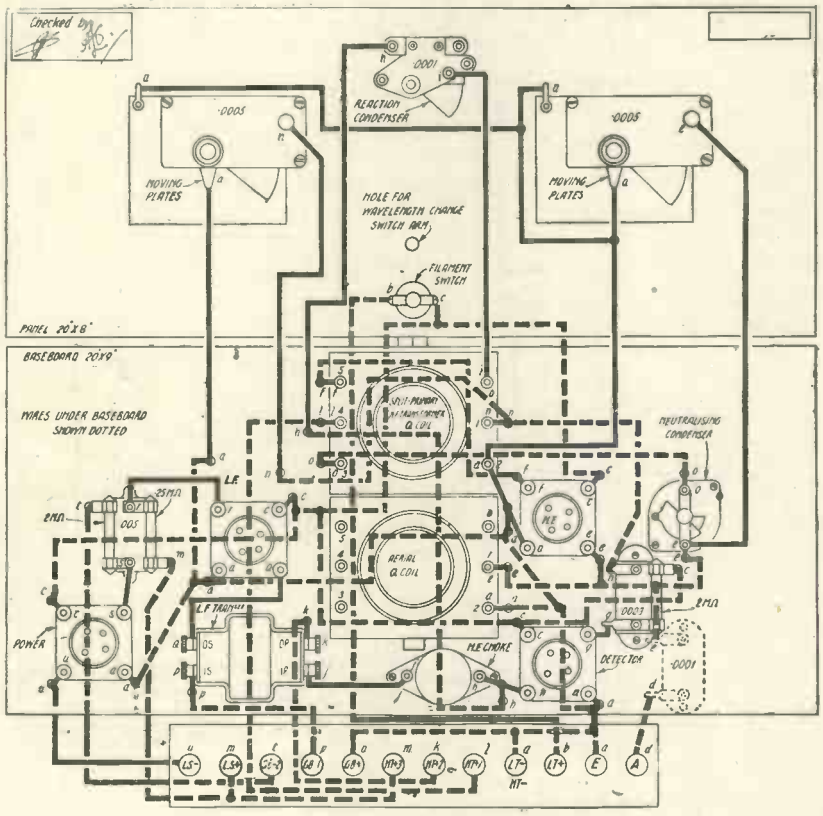


Panel layout of the Q-coil Four, not required if a full-size blueprint is used (see above)

Super-power Valve for Last Stage

Of course, the last valve should be of the super-power type, preferably with an impedance of less than 8,000 ohms. The quality of reception, although not the volume, is very

The Q-Coil Four (Continued)



Another wiring diagram of the Q-coil Four (not supplied as a full-size blueprint) The dotted lines indicate that part of the wiring carried out underneath the baseboard. Each connection can be followed through separately

considerably increased as the impedance of the last valve is brought lower.

To carry out a rough test of the receiver, place the valves in their respective holders and see that the on-off switch is "in," that is, in the "off" position.

Battery Voltages

Connect up the aerial and earth and apply voltages to the terminals as follows: To H.T.+1 about 60 to 80 volts; to H.T.+2 about 60 volts; and to H.T.+3 the full voltage of the battery, which should be at least 120 volts. To G.B.—1 apply about 3 volts negative and to G.B.—2 apply 9 to 18 volts negative.

To operate the receiver, pull out the on-off switch and adjust the reaction condenser until a slight rustling or hissing sound is heard; this indicates that the set is on the verge of oscillation and in a sensitive condition. Now turn both the large tuning knobs simultaneously until a transmission is picked up, when the reaction control should be readjusted until the best results are obtained. It may also be advisable to readjust both the high-tension and grid-bias voltages after a few stations have been tuned in.

Early in the first tests the high-frequency valve should be properly neutralised. Tune in a reasonably strong signal and switch off the high-frequency valve only by removing one of the filament connections from its holder. Now adjust the neutralising condenser until the signals become inaudible. When this occurs the valve has been properly neutralised and the filament connection can be replaced.

It should be noted that the receiver is adjusted for reception on the long waveband when the switch arm is moved to the right, and for the short waveband when it is moved to the left.

Mass (Re) Production!

HOW much does it cost you to run your receiver? Not much, you will probably reply, no matter whether it is a crystal set or a three- or four-valver. Even if you have a "super" set of five, six or seven valves the actual operating costs will be out of all comparison with the results obtained.

Eighty Loud-speakers

But suppose you were asked to operate a "super-super" set having nineteen stages of amplification and supplying 2,000 pairs of phones and about eighty loud-speakers! What would be the running cost?

The Lambeth Hospital, London, where such a giant set as this has been in operation for a considerable time, finds that the all-in cost is a penny an hour.

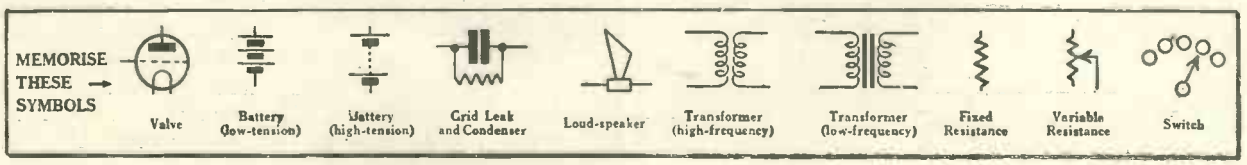
The set is quite automatic in working, and has a pre-set time switch, which charges the batteries and switches the receiver on to London or 5GB as required.

Thousands of Listeners At Once

As several thousands of patients are enabled to hear the programmes by means of this giant installation, the cost per hour is perhaps not so excessive as it may at first appear.

It is only another instance of mass production, or rather mass reproduction, making for cheapness!

QUEUE.



YOUR VALVE FILAMENT

Its Structure and Liability to Faults

SIR OLIVER LODGE, Vice-President of the Royal Society of Arts, was Chairman at a lecture given in the hall of this leading organisation on February 16, 1927, by Mr. Clifford E. Paterson, O.B.E., on the subject of wireless valves, and these notes are based thereon.

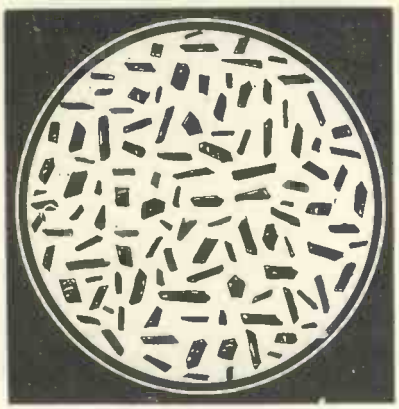


Fig. 1.—A pinch of tungsten powder greatly magnified. The metal cannot be melted; it is mechanically compressed and then drawn on wire. The granules are semi-crystalline.

The filament is the very "soul" of the valve; there must not be the slightest leakage in its vicinity, else it will corrode and spoil.

Tungsten is the usual metal employed to make it. This remarkable metal cannot be melted like most others, and after treatment of its ores it is isolated as an extremely heavy black semi-crystalline powder, as shown in Fig. 1.

Mechanically Compressed

This powder is mixed with a certain composition, is compressed mechanically, and subsequently drawn to wires.

Yet its treatment gives it a strength and tenacity equal to those yielded by steel heated to a temperature of between 200 degrees C. and 400 degrees C.

The resulting tungsten bar is wedged down, by stages, till it can be drawn through dies into filaments of .002 milliammetre diameter, resembling fine human hairs.

Even so that wire consists of myriads of individual crystalline granules, forced lengthways between one another, as shown in Fig. 2.

Re-crystallisation due to variations in temperature, oxidisation by leakage, air and vapour, and other somewhat obscure factors, causes it to become distorted, as shown in Fig. 3.

The blisters of tungsten oxide cannot transmit the current so equally as does the pure metal; hence disasters are likely to follow, or enable faults to develop which would not occur from the same sources, were the corrosion absent.

Adding Thoria

Some makers add a trace of thoria —that is, thorium oxide—to the tungsten to overcome certain spoliation tendencies. This compound will often restrain crystal growth; and so prolong the "active life" of a valve filament.

On the other hand, other makers add a trace of silicious soda to hasten

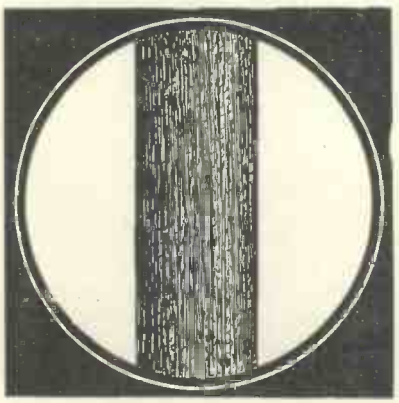


Fig. 2.—Enormously magnified valve-filament (really as fine as a hair to the naked eye) before being heated by electrical charge. It is fibrous through coalescence of its crystals longitudinally.

crystal growth so rapidly (before the valves are distributed) that when the filament is heated the wire becomes almost instantly a series of very long crystals, tenaciously and permanently held together.

Crystal growth having thus been accelerated *before* the wireless man uses his valve, it cannot happen *gradually* over a period of a few weeks or months (as is often the case), and so fail in its purpose.

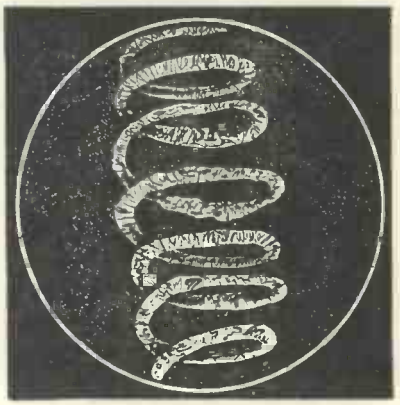


Fig. 3.—A portion of a valve filament, highly magnified, after becoming "cancerous" and distorted in the manner explained in the text.

The "mirror" of a valve is *not* quick-silver (mercury), but is a film of sublimed magnesium, and is there not so much to conceal the brilliant light of a working valve, but to absorb gases and vapours which may interfere with the character of the filament, that really has to endure wonderful experiences, all of them microscopically important as regards reception. JAMES SCOTT.

Four American women in one neighbourhood recently tuned-in on a dressmaking lesson from WGBS. The following Sunday, as ever was, the four blossomed forth in identical gowns, the four having followed in every detail the teacher's directions, even to material and trimming. American husbands who do not wish to be persuaded into buying their wives a wireless set for the home now quote this example of simultaneous dressmaking.

Read About the Crusader on Page 322 and Tell Your Friends

DO WE WANT TO HEAR PARLIAMENT?

A Special Article by JAMES P. GARDNER, M.P.

"I doubt it . . . And I sometimes think our tedious debates would make them weary"

THERE was once a time, when I had not been in Parliament so long as I have now, when I would eagerly have held up both my hands to vote for the general broadcasting of Parliamentary proceedings.

Boring Listeners Stiff?

But to-day I think I know better. I don't think the public would really want to hear us—however much some of us might want them to. I think we should bore them stiff and decrease their interest in Parliamentary affairs instead of stimulating it. I think the difficulty of arranging the time-table so that all parties had a fair show might cause disappointment among the listeners who failed to hear their favourites, and a certain amount of ill-feeling in the House.

And I think, too, that the technical difficulties in the way of broadcasting the debates in such a way as to render them intelligible to the listeners would be of such magnitude as to be almost insuperable. Let me indicate a few of them.

Daily Business of the House

Take the first daily business of the House—Question Time. To the visitor who sits in the Public Gallery of the House of Commons there is not a shadow of doubt that the hour between 2.45 p.m. and 3.45 p.m. each day, when members bombard and cross-examine Ministers on the work of their Departments, is the most interesting battle of wits that anyone could wish to witness.

The questioners, as a rule, are out to score a point off the Ministers, to corner them, to catch them napping, to involve them in a contradiction of some previous pronouncement, or to humiliate them in one of the hundred ways that Parliamentary procedure makes possible.

They hurl at them questions about Unemployment, Super-tax, Warships, the size of the Russian Army, how much we owe America, when Germany is going to pay, how many sailors caught influenza last autumn, whether the inmates at such-and-such a workhouse have butter or margarine for breakfast, and the Ministers, in the course of their replies, are always careful to try to whitewash themselves and their Departments, and to bang the questioner on the head—if he happens to sit on the other side of the House—with a rhetorical hammer big enough and heavy enough to keep him quiet and stop him from asking any further awkward questions for the rest of the day.

Sometimes the Minister wins; sometimes the questioner. Sometimes an answer leads to an angry storm; a breeze blows up; there are hard words; threats are thrown from one side of the House to the other; and the incident perhaps ends with some recalcitrant member being ordered to leave the House.

All this is exceedingly interesting—to the actual eye-witness. But it would be extremely difficult—if not impossible—to "get it over" on the wireless. In the first place, the questioners do not really recite their questions, but merely call out "Question Number So-and-So," as it appears in print upon the Order Paper.

And whilst, therefore, the radio listener would be able to hear the reply of the Minister, that reply would lose three-quarters of its interest in consequence of the listener having no idea of the question that the Minister was attempting to answer. The difficulty is overcome for the benefit of the visitors in the Public Gallery of the House by the provision of copies of the Order Paper which enable them to follow the proceedings intelligently.

Adequate Number of Microphones

Then, again, the technical question of providing an adequate number of microphones in the House would present some difficulty. It would be the easiest thing in the world for a microphone to be placed in front of Mr. Speaker, who presides over the deliberations of the House, and on the Despatch Boxes on the table between the two Front Benches, from which the Prime Minister and Mr. Ramsay MacDonald and their respective Cabinet and "Shadow Cabinet" colleagues address the House.

But there are five hundred or more M.P.s who have not the distinction of being entitled to speak from the Front Benches, and these Back Benchers are scattered in some hundreds of seats all over the House. How is it going to be possible to provide microphones which will be available for the use of all of them?

A "Mike" for Each Member?

It would be possible to require them all to speak from a central rostrum, I know, but the House would never agree to such a change, and, from my experience, it would not work, especially during the hurly-burly of supplementary questions or a particularly animated debate, when dozens of members are jumping on their feet at once with interrogations and interpellations. The only other way would be to provide each member

with a microphone of his own—and even that would not entirely solve the problem.

In a set debate which is fairly free from interruptions—such a debate as we sometimes get on Departmental Estimates—where one speaker follows another in methodical and pre-arranged order, I admit that there would not be so many difficulties to overcome as in the excitement of question time or the rough-and-tumble of a debate on some first-class political issue, where feelings run high.

Not Worth Hearing

But those routine debates would hardly be worth hearing. They usually deal with all kinds of detailed and technical points of Departmental administration, and there is very little about them to fire the imagination or rouse an audience to any pitch of excitement.

It is the big debates on questions like the Budget, the Zinovieff Letter, the Reform of the House of Lords, and the Prayer Book that make a real appeal—and in broadcasting them the difficulties that I have mentioned have always to be borne in mind.

Then there is the very important question of preserving the wireless from any suggestion of suspicion with regard to party preference or prejudice, and although the intentions of the authorities in control might be of the best, there are difficulties that would be put in their way as a result of the Parliamentary time-table and the rules of procedure of the House. Let me state the case of a few specimen full-dress debates to illustrate my point.

Declaration of Policy

In the case of a debate involving an important declaration of high policy by the Government, for instance, it would usually happen that Mr. Baldwin, Sir Austen Chamberlain, or whichever Minister happened to be making the statement, would have completed his remarks long before the majority of listeners arrived home from work in the evening and began their listening-in.

Similarly, in debates where Mr. Ramsay MacDonald or Mr. Lloyd George, on behalf of the Opposition, indicted the Government on a motion of censure with some dereliction of public duty their, speeches, too, would have been completed by five or six o'clock in the evening at the latest.

Listeners, therefore, would only hear the tail end of the debate, and the programme, to them, would be something like seeing a performance of *Hamlet* without the ghost.

Then take the case of the Budget Speech. Mr. Winston Churchill's speeches are always worth hearing. So are Mr. Philip Snowden's. So that whichever one of these happened to be Chancellor at the time could be relied upon to give what the programme compilers could describe as a real "star turn."

But the Budget Speech begins at about a quarter to four in the afternoon, and when the majority of listeners reach home at six o'clock it is all over. They would not even have the privilege of listening to the ex-Chancellor attacking the Chancellor on behalf of the Opposition and flaying his Budget proposals to pieces—sometimes a far more interesting "turn" than the actual Budget Speech itself—because this speech is

James P. Gardner, M.P., the author of this interesting article

always saved over until the following day, when it begins at a quarter to four again and finishes about half-past five.

All that happens on the evening of Budget Day, after the Chancellor has sat down, is that the House proceeds to pass some formal and tiresome resolutions which have no interest for the general listener at all.

The same thing happens with regard to that other great Parliamentary performance—the State Opening by the King. This takes place at noon, when every few listeners would have a chance of hearing it.

Then there is another disadvantage. Between the hours of about eight o'clock and nine-thirty, just when the listener would have finished his evening meal and settled himself down in a comfortable arm-chair by the fireside and adjusted his head-phones or his speaker, he would find practically nothing of importance coming through at all.

Filing Off for Dinner

The reason is that members begin to file off for dinner at about eight o'clock, and the only people who remain in the Chamber to carry on the debate are the Back Benchers, who find that the emptiness of the House gives them a chance of being called on to speak—a chance, which, had the House been full, would have been unlikely to come their way.

There are, moreover, innumerable points in Parliamentary procedure which would befog the mind of the ordinary listener, and our antiquated formulæ would seem like Dutch.

The confusion would not be lessened by the fact that members never refer to one another by name during debates, and there are many listeners who would not identify the Right Honourable member for Aberavon or the Right Honourable member for Carnarvon Boroughs as Mr. Ramsay MacDonald and Mr. Lloyd George respectively, with the result that much of the point of the speeches would be lost upon them.

Very Serious Difficulties

I might go on enumerating the difficulties of broadcasting Parliamentary proceedings *ad infinitum*. But I have said sufficient, perhaps, to show that there are very serious difficulties, and to show that the Westminster programme might not be quite such a bright and interesting one as some people are inclined to imagine.

I need hardly say that if the difficulties can all be overcome nobody will be happier than I shall. But it is buoying up false hopes to encourage the idea in people's minds that the B.B.C. is keeping from them an extra programme that might be theirs by the waving of some magic wand, and that they are missing something that would be in the nature of a "programme of all the talents." It would not.

If You Read This Article You Will At Once See Why You Should

Electrify Your Gramophone!

IT is my experience that many people—far too many people, in fact—have gramophones which do not give results as good as those obtained from their radio receivers, from the point of view of purity.

This is not the fault of gramophone manufacturers, but will always be so while a good set can be bought for much less than the cost of a mediocre gramophone *plus records*. Where the money goes is in acquiring records to give an entertainment comparing favourably with that obtained for a ten-shilling radio licence.

Gramophones & Gramophones

There are gramophones and gramophones, just as there is your wireless set and the cacophony-creating gadget belonging to the man next door.

If it were ever your lot to make gramophones for selling at "cut" prices (and thank your lucky stars it is not!) you would find that the place to save most money is the sound-box. From the point of view of music alone it does not matter very much if the cabinet is solid oak, or deal, or has "Tate" painted at odd places on the inside.

What *does* matter is that the sound-box should be made with strict regard for certain technical details, the nature of which need not bother you very much.

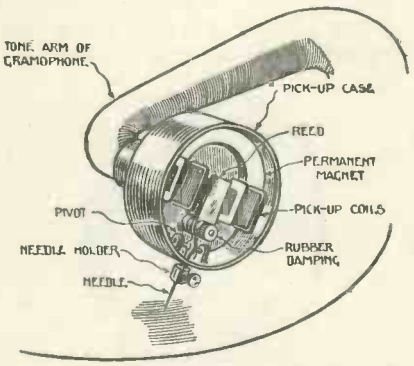
A Vast Improvement

Now see how an inferior instrument may be improved almost beyond recognition by using an electrical pick-up and reproducing records through the loud-speaker. Forget, first of all, much that has been said about pick-ups being suitable for large sets and for public-address work. This is so, but it is not the limit of their capabilities. *Remember that a pick-up costs less than the price of a dozen records.*

Two stages of low-frequency amplification should follow the pick-up, but this does not mean that a three-valver of the popular detector-two-L.F. type is the smallest set that can be used. A pick-up can be added to the grid circuit of a detector, and (provided grid bias is altered to suit) the detector functions as an amplifier for the low-frequency current generated by the pick-up reed.

This brings humble two-valvers, with either transformer or resistance-capacity coupling into the bounds of pick-up possibility.

These are the advantages which accrue from "electrifying" a gramophone: vastly better reproduction, equal, in fact, to the set working at its best at full volume; easy volume control, complete absence of needle scratch, less wear on records, reproduction of detail which in some instances of sound-box reproduction is *entirely lacking*.



This sketch clearly shows the principle of operation of an electrical gramophone pick-up

Some explanation of this last rather startling fact is needed. For some time past all the big gramophone companies have made use of electrical means of recording. The artiste when recording performs in a draped studio before a conventional "mike." He or she might be for all the world in a B.B.C. studio. The sensitive microphone picks out a wealth of detail which the old diaphragm failed to record. The detail is in the master record, and it is in the commercial impressions, if only we can get it out.

Gramophone sound-boxes are not much improvement upon the diaphragm recorders and that is why many gramophone enthusiasts are still blind to the full beauty of the lastest electrical recordings. Electrical recording means electrical reproduction in order to achieve purity.

Better than a Sound-box

There are further reasons why a pick-up, connected to a receiver which gives even moderately good radio reproduction, can put a sound-box to shame.

Many of the electrical pick-ups on the market are lighter in weight than sound-boxes giving anything like equal results. Heavy sound-boxes lead to slipping of the record on the turn-table, and cause a most unmusical dropping of pitch when, say, a soprano reaches a vigorous high note—that is, when the needle reaches a deeply engraved wave form.

A pick-up does not wear a record so much as a sound-box, because, volume for volume, a pick-up needle is a *relay* of energy from the H.T. battery, whereas a sound-box generates sound-waves from movement which the needle must obtain from the record impressions.

Good "Radio" Set Essential

It will be assumed, naturally, that if you have a pick-up and are dissatisfied with the results it gives, you have tested the set to which it is connected. Good radio reproduction is a necessary preliminary.

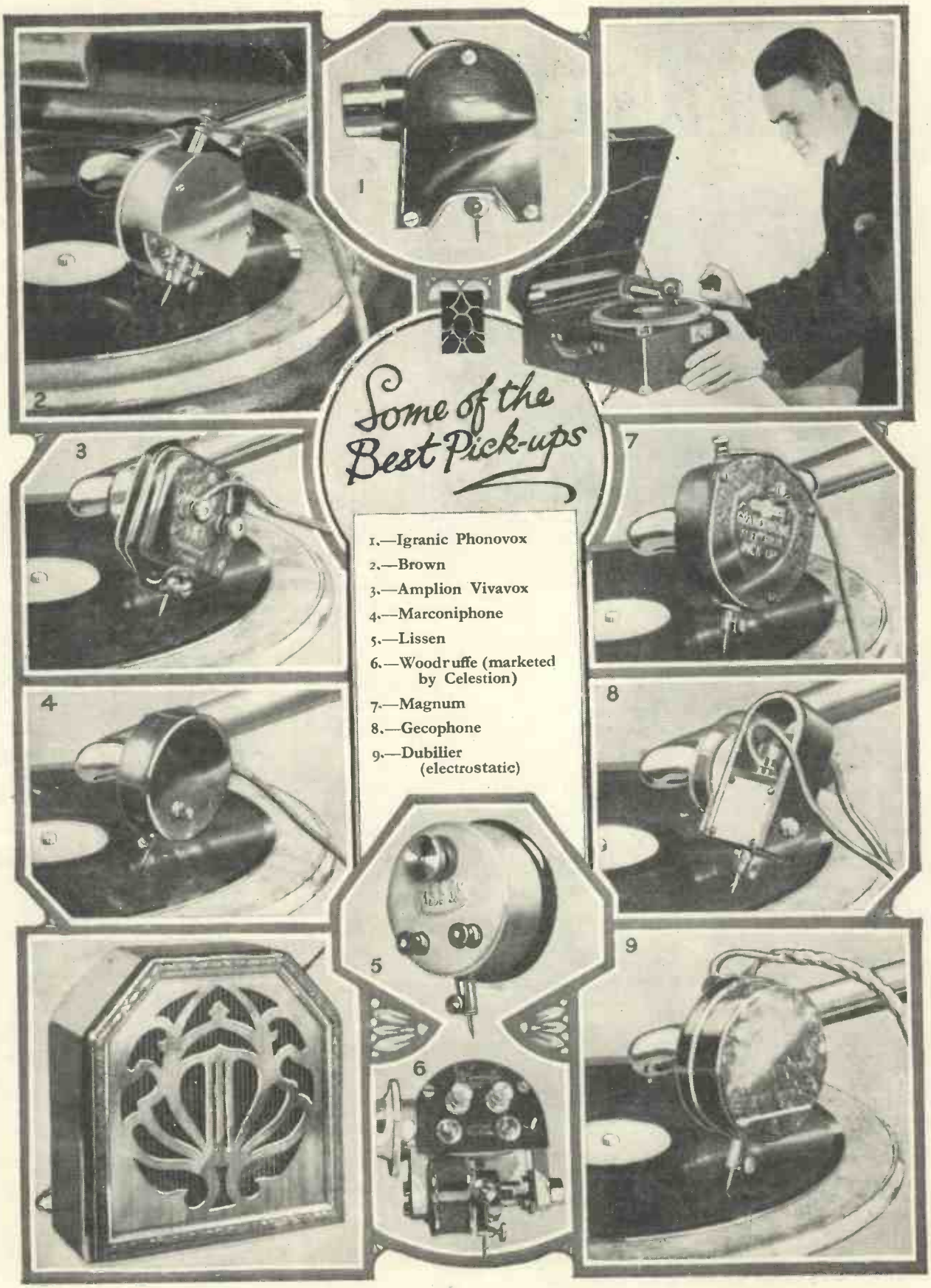
The following two hints are the result of experience with pick-ups which have been believed faulty owing to incorrect methods of using them:

Before using a record, brush over it with a velvet or similar soft pad.

Avoid handling the faces of records, for the composition of which the plates are made readily absorbs grease.

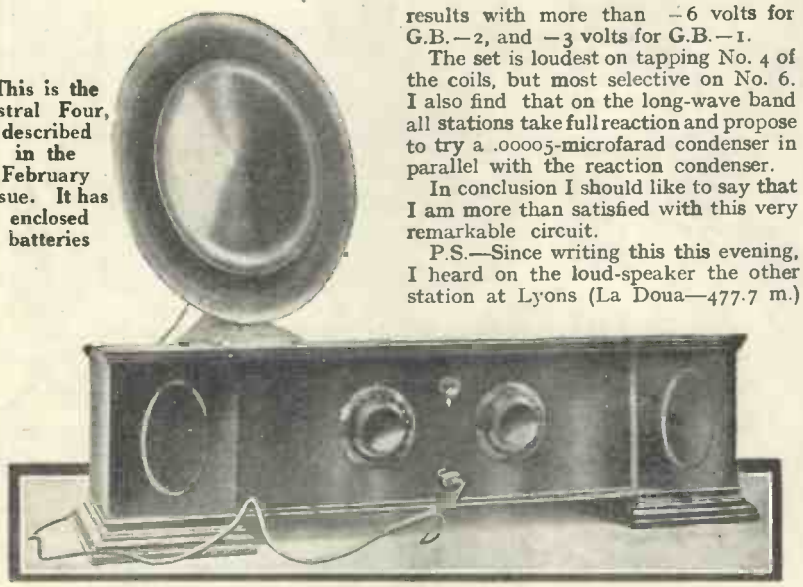
2 BZL

Why Not Build the Gramo-Radio Four? See page 337


Some of the Best Pick-ups
1.—Igranic Phonovox
2.—Brown
3.—Amplion Vivavox
4.—Marconiphone
5.—Lissen
6.—Woodruffe (marketed by Celestion)
7.—Magnum
8.—Gecophone
9.—Dubilier (electrostatic)

There Can Be No Better Recommendation for the "W.M." Than

What Readers Think of Our Sets



This is the Astral Four, described in the February issue. It has enclosed batteries

ASTRAL FOUR

AS one of the few four-valvers published up to that time that would receive on both wavelength ranges without changing coils the Astral Four (WIRELESS MAGAZINE, *February*, 1928) *proved a great success. Here is what a Heckmondwike reader says*:

Have just built your Astral Four as laid out in your February issue. A truly wonderful set; can get anywhere. A station at every point on the short waves and a multitude of stations on high waves, all at loud-speaker strength.

Valves used are 2-volt and the H.T. is supplied from an eliminator.

I can safely recommend the above as a good searcher of the ether.

Another reader at Hindhead has been just as successful:

I think you might be interested to hear my experiences with the above-named set—I have received 38 stations at good loud-speaker strength, namely:

Aberdeen, Barcelona (both stations), Bournemouth, Berne, Breslau, Cardiff, Cologne, Copenhagen, Dublin, Daventry (5XX and 5GB), Frankfort, Hamburg, Hilversum, Kalundborg, Cattowitz, Königsberg, Königswusterhausen, Kiel, Langenburg, Leipzig, London (2LO), Lyons, Malmo, Manchester, Milan, Madrid, Muenster, Munich, Newcastle, Nuremberg, Prague, Paris (Ecole Supérieure and Radio Paris), Stuttgart, Toulouse and Vienna (Rosenhagel).

I find where I live in Surrey that an east-west aerial gives the best results, and also that even using 150 volts for the H.T. + 2 I do not get good results with more than −6 volts for G.B.−2, and −3 volts for G.B.−1.

The set is loudest on tapping No. 4 of the coils, but most selective on No. 6. I also find that on the long-wave band all stations take full reaction and propose to try a .00005-microfarad condenser in parallel with the reaction condenser.

In conclusion I should like to say that I am more than satisfied with this very remarkable circuit.

P.S.—Since writing this this evening, I heard on the loud-speaker the other station at Lyons (La Doua—477.7 m.) and Tangier, this bringing the total number of stations up to 40.

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1927-1928 FIVES

Although the 1927 *Five was described so long ago* (WIRELESS MAGAZINE, *October*, 1927), *and has been superseded by more recent designs, we still receive letters regarding its good performance. Here is one from an Edinburgh reader*:

It may be of interest to you to know that for the past fifteen months I have been using the 1927 Five receiver which was described in your magazine. Up to the present I have logged forty-eight stations, including Schenectady, all of which have been received at full loud-speaker strength, weather conditions permitting.

I may also mention here that the stations I have logged do not include any of the high-wavelength stations as I never wound coils for same.

This reader might be even better pleased if he revised his set on the lines of the 1928 *Five as a West Newport reader has done*:

Just a note to let you know the results I am getting from the 1928 I have built. I have revised my old 1927 Five and if any owner of the "1927" takes my advice he will change it *at once*. The "1928" is far superior to the old set, and very easy to control, better tuning and better tone. I have tested it and get stations by the dozen, without any sign of oscillation, all barging in on the loud-speaker.

I won't look for a better when I have this. It is a "champion," and I thank you very much for as good, if not better, a set than any I've heard.

"SIMPLER WIRELESS" SETS

Readers fortunate enough to have a 200-volt D.C. supply in their houses have had many problems solved by using one or other of the "Simpler Wireless" sets described in these pages (WIRELESS MAGAZINE, *October, November, December*, 1927 *and February*, 1928). *A Birmingham reader makes some interesting comments*:

I have built every "Simpler Wireless" set which has been published, and now have in use the Metropolitan Three, which I consider the best of them all. Hum is almost nil and less than in the other sets.

I have dispensed with an earth connection as it does not make the slightest difference.

Purity of reception is excellent and could not be improved upon. I am more than satisfied and hope you will soon give us a five-valve set, but if you do, please arrange a switch to cut out the last valve as volume would be too great on the Daventry's (my local's).

A Shrewsbury reader is equally enthusiastic about "Simpler Wireless" sets:

As a very satisfied reader of the WIRELESS MAGAZINE, I feel I should like to congratulate you and Mr. Johnston on the success of the "Simpler Wireless" system so far as I am concerned.

For experiment I built the Mains-fed Two, and was delighted with the simplicity of the arrangement and with results.

Desiring more power, I converted same into the Metropolitan Three, and am far from disappointed (particularly when the local 'lemon' juice is taken into consideration).

We are a goodly distance from the B.B.C. stations and so, of course, I have not yet hit upon the ideal "Simpler Wireless" set for my requirements. I hope, therefore, that more receivers by Mr. Johnston will soon appear, particularly now moving-coil loud-speakers are appearing.

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EXHIBITION FIVE

That "star" set of the autumn, the Exhibition Five (WIRELESS MAGAZINE, *October*, 1927), *has given great pleasure to a large number of listeners. Here is a letter from an Exeter reader who is getting good results*:

I have now finished the Exhibition Five and incorporated a valve in parallel in last stage; it is very fine indeed. We are only using B.B.C. wavelength at present. The results are equal to expectation, to say the least; please accept my thanks for the set and help you have given me. I am most grateful.

You will understand it was not exactly simple for me when I tell you that this is the first set I have built myself (I have always paid an electrician to build my others), but I have done it completely by myself and incorporated the tone-filter control with it.

We are anxious to get the Daventry coils, as we expect something out of the ordinary with them. Morse and spark spoils the short waves here very much.

I have inserted my milliammeter; it registers 14 milliamperes with about 14 volts grid bias and is steady as a rock.

While I am writing this, 5GB is filling the room with the Royal Air Force Band to perfection through the moving-coil loud-speaker.

Another reader in Manchester has been able to get American stations direct. He says :

When I was endeavouring to get Madrid at 12.10 on Sunday morning (March 4), I was surprised to hear an announcer speaking in English with an American accent. Hence I tuned in as loud as possible and found the station was WBZ. Philadelphia. The details of the programme I give on another page . . .

My set is in no way altered except for valves. It is, in my opinion, a great performance by a great set, and I heartily congratulate the WIRELESS MAGAZINE technical staff.

One reader in Bradford, owing to the use of some wrong components, thought he had a "dud"—but he soon changed his mind :

After many thoughts concerning the Exhibition Five, I have decided to forward my opinion concerning it. It will be about four months since I started construction on it. The wiring was soon completed, but music, etc., was reluctant to come through. Shorting occurred, but where I could not discover. Solved at last in the vicinity of the jacks, it was put right. (N.B.—Excuse my ignorance, as I had never had a jack in any set of mine previous to this.)

Now, thought I, for results. Neutralising proved difficult, it being found necessary to have all five valves going to hear anything. However, thinking I had done this, I prepared to receive them—that is, the countless stations. I got about eight at poor strength.

This time it was wrong coils, as all stations received had been between 140 and 180 degrees on the aerial condenser. I was just about in the fetch-a-hammer stage.

Well, the coils were exchanged, and I, not expecting anything worth mentioning, popped them in. The results staggered me, I had never heard a five-valve set all out before, and it was something of a shock to me the way they leapt in.

I am afraid I shall get blasé with too much of it. I can hardly fail to land something when I switch on.

I have burnt the midnight oil on two or three occasions and have receeived WPG, KDKA, WGY, WBZ, KOA, and one or two others I could not catch. Europeans are as common as daisies. Success is mine as a copyist, and success belongs to your paper as the designer. May the WIRELESS MAGAZINE live for ever!

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REVELATION FOUR

Although it has since been superseded by more recent designs the Revelation Four is a most successful receiver (WIRELESS MAGAZINE, *August*, 1927), *and many are the letters we have had in its praise. Here is one from Halifax:—*

Just a few lines to express my appreciation of the Revelation Four, which I have had working now for two months, so as to give the set a fair test before reporting on it to you.

I can receive the following stations easily: Leeds, Bradford, London, Daventry, Manchester, 5GB, Dublin, Newcastle, Langenberg, Berlin, Stuttgart, Hilversum, Oslo, Radio Paris, Hamburg, and several I cannot identify.

I must also congratulate the WIRELESS MAGAZINE Staff on the design and success of the set. I may say I am a raw novice and knew nothing about wireless before building it, so beginners need not be afraid to build their own sets from the WIRELESS MAGAZINE as everything is so clearly described and the blueprint is quite easy to follow.

I may say the first time I plugged in the set worked and the volume scared me; I was not expecting such a row. To close, I must thank you for a really good four-valver that *does* deliver the goods. Wishing the WIRELESS MAGAZINE every success.

One Revelation Four is in use in a Swiss village, Davos Platz, and its owner writes :—

I wish to congratulate you on a perfectly marvellous set, namely the Revelation Four.

I built this set in England and at the first test it produced about twenty stations on the loud-speaker. Afterwards when I brought it out, and made a few trifling alterations, imagine my amazement when I logged forty-seven stations on the loud-speaker, including London. Also I can sometimes get America. Many other stations come in which are too numerous to mention. Wishing your paper all the luck it deserves.

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NOMAD SIX

The demand for a six-valver is, of course, limited, but those who built the Nomad Six (WIRELESS MAGAZINE, *September*, 1927) *have found it to be worth the trouble. A reader living at Leatherhead writes :*

I am by no means an expert in wireless, but to show the facility with which a novice may be able to construct one of the sets described in your magazine may I state briefly my recent effort in regard to the Nomad Six?

It is the first set of any kind I have ever attempted to construct and, warned as I was of the magnitude and complications of the task, I have recently completed it, without assistance.

I tried it out on Saturday last, and with an excellent outdoor aerial I was, I can assure you, very agreeably surprised when the set functioned with success at once. I probably shall have some grid-bias adjustment to make and perhaps a few variations in H.T. voltages.

I have a good loud-speaker and the quality from the Nomad Six was exceptional. Numerous foreign stations I was able to get; in fact, they came in very readily, and in time I hope to identify them.

As you say, it is a set to be proud of, and I agree.

Beginners do not often start their radio activities with six valves, but another reader, at Hornsey this time, made the Nomad Six as his first receiver :

I constructed my Nomad Six just after Christmas, and until I can run it from the mains I have been running it on two 100-volt batteries. They are just about finished now, as the milliammeter shows 5 milliamperes on the last two valves, despite which both London and Daventry (5GB) can both be brought in at uncomfortable loud-speaker strength on an indoor aerial 6 feet long. Langenberg and Breslau come in easily on an outdoor aerial 11 feet long.

This is the first set I have ever constructed and it will be the last, as I consider this set is at least five years before its time. I do not think I shall ever hear another set bring in foreign stations with such volume and purity.

The valves have shown great endurance, as when I first worked the set I connected the grid bias on the wrong way with the result that instead of 24 volts negative bias, they got 24 volts positive and burnt out the milliammeter. The valves show no sign of any harm, so I am still using them, Thanking you for the finest set I have ever heard.

Wireless Magazine, May 1928

Captain H. J. Round, M.I.E.E., the Well-known Pioneer, Discusses

GETTING MORE POWER FROM THE POWER VALVE

IN endeavouring to avoid distortion in the low-frequency circuits, there has been a tendency to limit the power that can be obtained from the last valve. I have been working

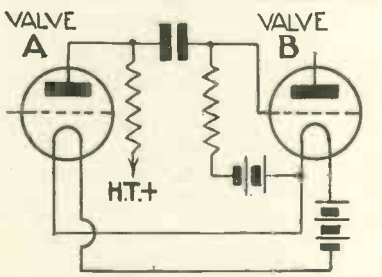


Fig. 1.—Resistance-coupled Amplifier

out a few cases recently, and the results will be interesting to many readers of the WIRELESS MAGAZINE.

Suppose we have a loud-speaker and in series with it we put a battery and a make-and-break contact. Then, on making contact, a current will flow through the loud-speaker, this current being limited by the resistance of the loud-speaker winding only.

If in series with the circuit we put a resistance, we cannot get as much current into the loud-speaker, and the higher the resistance is the smaller the current obtainable.

Greater Power Output

It is obvious from this that if the make-and-break contact and the resistance are replaced by a valve, then the lower the resistance of the valve, the larger the maximum current we shall get—that is, the more will be the power output.

If we replace the make-and-break contact with a valve plate-to-filament connection, then when the grid is given a high negative potential, we have the equivalent of the contact being open, but if we make the grid positive, this is equivalent to closing the contact. The valve, however, has a resistance which absorbs some of the volts really wanted across the loud-speaker, so that to some extent the true equivalent is the make-and-break contact with a resistance.

It is usually considered that grids shall not be carried to a positive potential because of distortion, but I shall show presently that this is not an absolute necessity.

A Series of Valves

For the moment we will consider a series of valves in which we will study the resistance when their grid bias is just brought up to zero. Take the three old standard valves, the DE5A, DE5, and DE5B. With the same plate volts the DE5A will pass a larger current at zero grid volts than the DE5 and the latter will give a larger current than the DE5B.

The valves have a very similar construction to one another, but the DE5A has a much more open grid than the DE5 and the latter is more open than the DE5B.

The result is that we can get most power output from the DE5A, but at the expense of more input, for if the DE5A requires 10 grid volts to reduce its current to zero, the DE5 will only

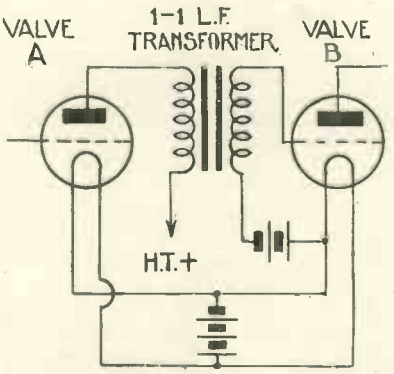


Fig. 2.—Transformer-coupled Amplifier

require 5 grid volts and the DE5B only 2 volts.

The advantages of this condition of no grid current are obvious—for no load is thrown on the previous valve and we can use a resistance-coupled amplifier or a high-ratio step-up transformer (see Figs. 1 and 2).

There is, however, another way to solve the problem, for if we study Fig. 1 carefully, we shall see that the grid circuit of valve B, if a positive potential is applied, becomes of low resistance and drops the applied potential from valve A, rather

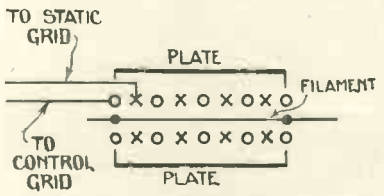


Fig. 3.—Two Grids Interwoven

seriously causing distortion of signals.

If, however, the valve A is of a low-resistance type, then, providing the plate resistance rod is also of low resistance, so that the valve A is really being used at a low-resistance point, grid current can be permitted in valve B, the condition for effectively guarding against distortion being that the grid resistance of B shall not ever be as low as the resistance of the valve A.

Accurately considered, of course, the valve resistance, plus the plate resistance and grid leak, must be taken in parallel.

Another Action to Consider

Of course, in this particular circuit another action will take place, helping to distort, and that is the charging of the condenser from the grid current; and for this reason the simple resistance-coupled amplifier is not too nice in the circumstances.

If we now examine Fig. 2 with the 1 to 1 ratio transformer, then the action is primarily the same as in Fig. 1—that is, providing the grid

resistance of the power valve never comes as low as the anode resistance of the previous valve, we are safe from distortion, only in this case we have not to worry about condenser charge.

Raising the Ratio

Suppose, however, we raise the transformer ratio, say, to 3 to 1—a more normal transformer—then the effect of any grid resistance is greatly exaggerated, and the valve before the power valve, would have to be $\frac{1}{9}$th the resistance necessary in the 1 to 1 transformer case, and running into grid current is hardly permissible.

There are thus two main alternatives for getting larger power output:

1. (*a*) To use an open-grid mesh valve, and a high "mu" resistance-coupled stage before it, or

(*b*) a 3 to 1 ratio transformer with a similar valve to the power valve.

In neither case is grid current permissible.

2. To use a medium-mesh valve and work from a similar valve through a 1 to 1 transformer, driving well up into grid current.

If the second method is taken to the extreme, we can drive an open-grid mesh valve well up into grid current and get the absolute maximum of power out of a valve of that size.

More Load on Previous Valve

We are doing this by throwing more load on the previous valve. When using either the open-mesh method or the second method of driving into positive grid current we lose magnification, and this will have to be gained elsewhere in the circuits.

I have calculated one particular case the result of which calculation will be interesting. The particular valve considered was the DEP610, a normal power valve. With a 1 to 1 transformer another DEP610 will drive this valve up to 10 volts positive grid swing without serious distortion, and with 120 plate volts this will give three times the amount of power to the loud-speaker than can be obtained if the ideal condition of no grid current is maintained. Surely this extra power is worth having, even at the expense of some loss of overall magnification?

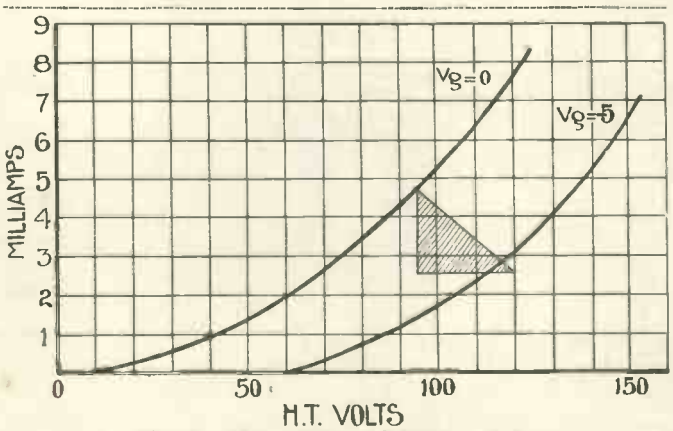


Fig. 4.—Characteristic of Valve as Triode

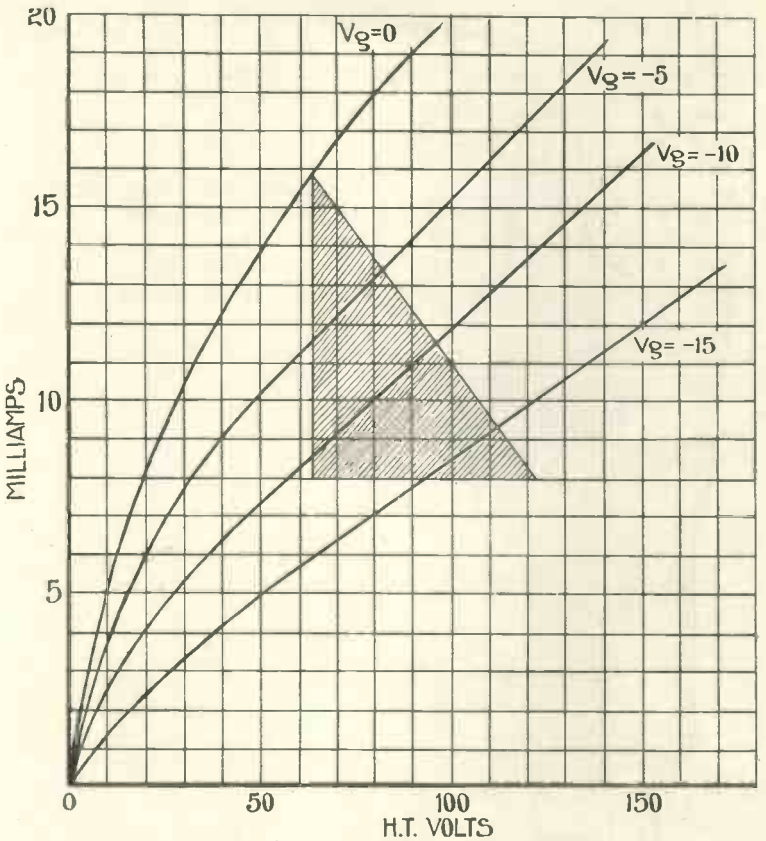


Fig. 5.—Characteristic of Valve as Tetrode

In considering this problem, I asked myself if there was any other way of obtaining this large power output from a valve without the necessity of running into grid current, and I was able to get a valve made to try an experiment of a very simple nature.

If the grid of a valve is made of two spirals—interwoven but insulated from one another, each grid being the same distance from the filament as the other one (see Fig. 3)—then it is quite easy to see that if one is charged positively to, say, 10 volts, then 10 volts negative on the other one will give the same effect as if both grids were at zero potential.

Composite Grid Voltage

But note the point that if one is charged statically (with a battery) to, say, 10 volts, then if the other one used as the operating grid is brought just up to zero, where its own grid current starts, the composite grid is really at 5 volts. We have succeeded in driving into grid current without real grid-current loss.

In the actual experimental valve made, with an expenditure of 12 milliamperes at 48 volts on the static grid I could get eight times the power from the valve without

Getting More Power from the Power Valve *(Continued)*

A Mullard Power Valve

running into grid current on the operating grid, and there is no loss of magnification.

Paying with Milliamperes

Thus, instead of paying for the power output by loss of magnification, as we have to do in the triode case, in this simple tetrode we pay for the power output with D.C. milliamperes.

For those interested in the question from the characteristic point of view, I attach in Figs. 4 and 5 the characteristics of the valve as triode and as a tetrode with 48 volts on the one grid.

It will at once be seen from these cases that a great deal more undistorted energy is available in the positive grid case; the undistorted energy in each case I have represented as a triangular area.

Difficult to Make

Valves such as my experimental one are difficult to make, because to interleave two spirals and insulate them from one another is too much to ask the valve maker to do, but let us see what will happen if we put one grid outside the other one, as in Fig. 6—which is quite a practical thing to do.

Then in this case if the outer grid is the statically-charged one the inner grid will shield its action from the filament by a certain amount, so that more volts will have to be supplied to it to get the same effect as before.

Thus, in the simple interwoven-spirals case, 48 volts would be ample to permit of large currentless grid control, but if the static grid is removed to a position outside the operating grid, then the voltage may have to be raised to 120 volts, or even higher, to get the same effect; in this case some secondary effects will occur which will have to be taken account of.

In general, however, it will be possible to obtain the same big power outputs as in the simple interwoven-grid case, if the necessary precautions are taken.

If the static grid is placed inside the control grid similar reasoning can be applied. In this case larger control voltages and smaller static voltages will be the rule.

It is an interesting problem to try and reason out what will happen if, starting with the static grid inside the control grid, this is imagined as gradually passing through the control grid and then its mesh slowly closed up, as in the shielded high-frequency valves.

We have thus available three methods of obtaining more undistorted power from the power valve.

The first method is to open the grid mesh so wide that large currents pass at zero grid volts, and this method is well known and in much use.

The second method is to bring into action the power possibilities of the previous valve, give it some work to do, and drive right up into grid current in the power-valve. (Both the methods gain output at the expense of magnification).

Third Method

The third method is to use a special valve with an auxiliary grid, and with this obtain both big power output and high magnification, paying for it with milliamperes to the auxiliary grid.

Valves in which the static grid is placed outside the control grid have secondary actions which need arresting before the valve can be used to the best effect.

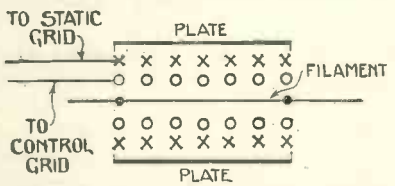
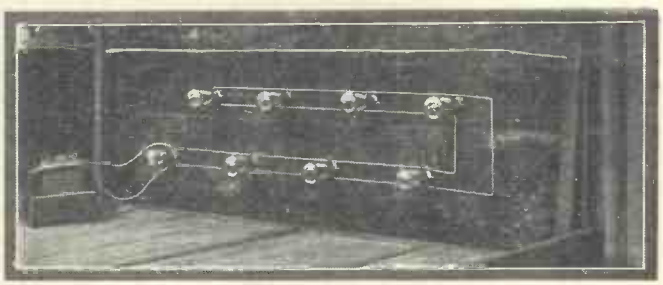


Fig. 6.—Two Grids, one arranged outside the other

Those who have studied the action of tetrodes such as the S625 will have recognised that the curious characteristic, part of which is of negative-resistance character, will prevent them being used for power output purposes, but it is well known now that this defect can be renewed by the introduction of yet a further grid.

I shall have more to say about this double-grid power valve in future articles in the WIRELESS MAGAZINE.

WHY YOU SHOULD USE ANTI-MICROPHONIC HOLDERS



Although modern valves are quite mechanically strong in themselves they can be made absolutely safe in use by mounting them in good anti-microphonic holders. These Lotus valve holders were screwed to the back of a motor lorry which was run many miles over bad roads. The valves were in perfect condition after the test. Here is a moral for portable-set constructors!

Do We Need Specialised Broadcasts?

ON the Continent it is claimed that the Dutch stations broadcast the most educational and specialised matter. The language courses are graded with great care and a listener can start on a new language every quarter. There are four courses in the English language at present.

From Hilversum and Huizen

From Hilversum and Huizen there are specialised courses on "Shipping for Bargees and Their Families," "How to Make Handy Objects," Stenography, Book-keeping, and Esperanto, in addition to dozens of other subjects.

As a general criticism it is true that the B.B.C. have not set out to cater for the specialist. There are plenty of casual and haphazard talks on most subjects, but no definite policy seems to be followed as is the case in many other countries.

Recently, Milan gave a course of talks on stamp collecting, indeed, one of the cleverest series that could have been broadcast. The only danger of that course would be to make every Italian a stamp collector. One talk on a subject such as this leads no one anywhere. It wants to be followed up by a series.

One of the Mid-American stations has a series at present on "Careers for Women." There are plenty of articles in our daily newspapers about choosing careers for our daughters, but there have only been one or two casual talks on the subjects from the B.B.C. studios.

Talks to be of any value will have to be "specialised" and made so interesting that the series will grip as the B.B.C. series on "Music and the Ordinary Listener" has gripped.

A series on Morse Signals would be of great educational interest to the average listener, and these could be demonstrated. There is no subject on which the average listener is so ignorant, and yet there is no subject so systematically ignored in the B.B.C. programmes.

A Canadian station has given a series of talks on Morse although no listener within a hundred miles of the station can hope to get within striking distance of any sea for a few years, nor be troubled much by Morse signals.

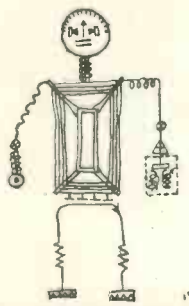
One French station broadcast a series of very successful talks on First Aid a year or so ago. A German station about the same time broadcast a series on Aeroplane Construction.

Talks on Building Sets

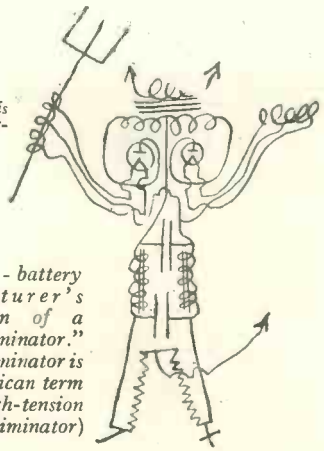
All round the programmes are becoming more specialised. Perhaps the day will come when the editor of the WIRELESS MAGAZINE will be invited to broadcast a series of talks on "How to Make a Wireless Set" from 2LO.

In any case it is specialisation that will pay and make us masters of a few things, instead of being bored with the casual talk. In this matter at least, other countries are giving the lead to us. What are we going to do about specialised broadcasts? E.B.R.

SOME RADIO "BUGS"! *Imported from America*



This is Low Pantenna, found only in the wilds of Laboratoria. His eyes can detect anything, and he is holding a Pendyne, a weapon against the tribe of Poo Receptionia

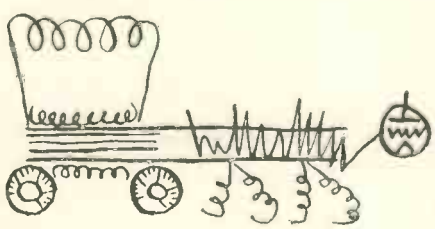


NOTE. — This is an actual circuit diagram.

A Dry-battery Manufacturer's Impression of a "B-Eliminator." (A B-Eliminator is the American term for a high-tension battery eliminator)

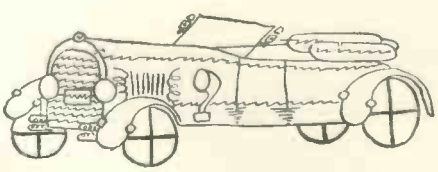
Parade of the Thoriated Soldiers: The Nine-in-line

The D.X. Hound: Observe the distance-getting nose, the crystalline ears and last, but not least, his tales, which pass all understanding



(Right).—The effect of progress—the Radio Car

(Left).—The Ham's Covered Wagon



—"Radio News," New York

A Very Cheap and Simple Two-valver for Short-wave or Broadcast Reception

The Crusader

Designed, Built and Tested by the "W.M." Technical Staff

IN this article the WIRELESS MAGAZINE Technical Staff is able to offer its readers complete constructional details of a very cheap two-valver that is equally efficient on both the short wavelengths and on the ordinary broadcasting wavelengths.

Actually its cost is about £2 15s. (less if suitable alternatives are chosen) and it can be put together and wired up within an hour or two, even by an inexperienced amateur.

Most of the components are mounted direct on a baseboard, a few only being fixed vertically on small ebonite supports. No cabinet is needed and everything about the set is easily accessible for experimental purposes.

The Crusader ready for action

Range and Volume

The greatest possible range and volume from a two-valver are ensured by the circuit employed, which comprises a detector and one stage of low-frequency amplification. Leaky-grid rectification is used as this is more sensitive than the anode-bend system, and magnetic reaction is provided, the amount of feedback being controlled by a small variable condenser.

Advantages of Plug-in Coils

Flexibility of wavelength range is obtained by using plug-in coils; those of the make used in the original set are almost as efficient on the very short waves as they are on the normal broadcasting wavelengths.

To combine sensitivity with ease of control, a special reaction arrangement is employed.

Everything possible is got from the two valves used by supplying their anodes separately, so that each can have just the right voltage on it. Grid bias is applied to the low-frequency amplifier.

From these brief remarks it will be evident to WIRELESS MAGAZINE readers that everything possible has been done in this receiver to get the greatest possible efficiency, and at the same time the cost of construction has been kept low.

For Loud-speaker or Phones

The Crusader will, under all ordinary conditions, receive several broadcast programmes on the loud-speaker and as for the headphone range, well, that is unlimited. With this set it is an easy matter to pick up the chief American short-wave stations and, with luck, it may even be possible to hear Australia.

Very few indeed are the sets that

A Cheap Two-valver with Unlimited Wavelength Range

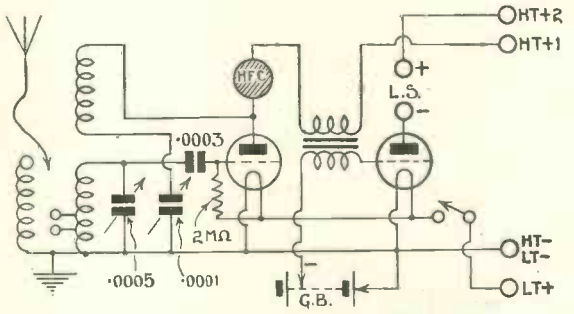
can be claimed to be equally efficient over the whole working range of wavelengths. In wireless simplicity nearly always means efficiency and the Crusader is *not* the exception that proves the rule.

Those who have been interested in the remarks so far made will be glad to "dissect" the circuit diagram reproduced on this page and see exactly how the receiver is arranged.

Circuit

No doubt to many readers the tuning arrangement will seem a mysterious affair, but actually it is quite straight-forward. Two coils are seen, side by side, with their bottom ends joined together and earthed. Well, the two coils are used only for reception on the short-wave band, when that on the left acts as an aperiodic aerial coil and that on the right as the main tuning coil. In this case the aerial is, of course, connected to the top of the left-hand coil.

For reception on the ordinary broadcast wavelengths, sufficient selectivity can be obtained without this aperiodic arrangement and in this case only the right-hand coil is used (actually, of course, this means that no coil is inserted in the other holder). This coil, however, is of the tapped variety and the aerial is connected not to the top end of the coil but to a tapping.



Here is the simple circuit of the Crusader, a cheap two-valver

Either centre-tapped or double-tapped coils can be used, the latter being slightly more selective than the former. Normally a centre-tapped coil will give the desired degree of selectivity, but where the set is to be used within a very few miles of a broadcasting station a double-tapped coil is advised.

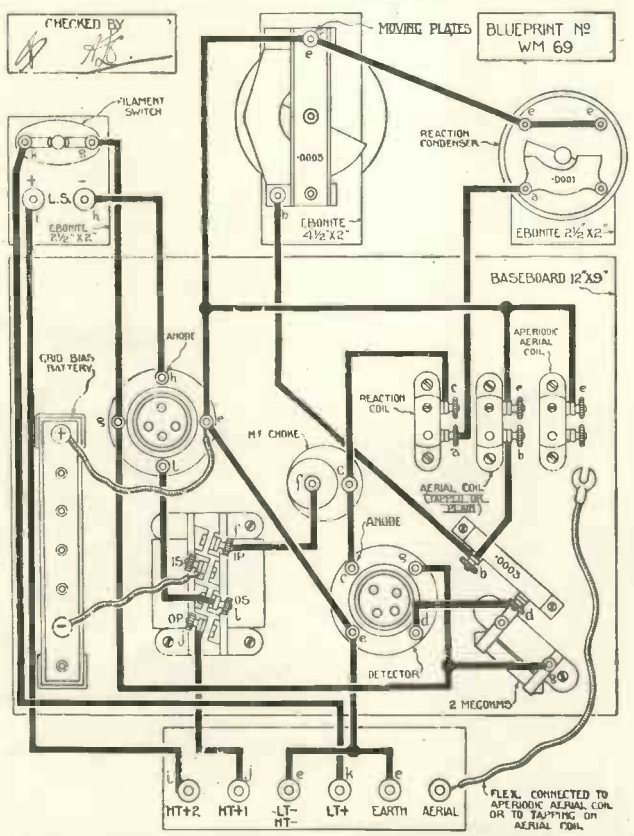
Rectification is carried out on the leaky-grid principle as this gives the greatest possible sensitivity. A .0003-microfarad grid condenser is used in conjunction with a 2-megohm leak, one end of which, it should be specially noted, is joined to low-tension positive and not to low-tension negative, as is sometimes the case.

From the anode of the valve energy is fed back to the grid through a reaction coil and condenser, the latter controlling the amount of feedback.

Choice of High-frequency Choke

Particular note should be taken of the fact that reaction will be unobtainable and the set will be very inefficient if the high-frequency choke inserted in the detector-valve anode circuit does not function efficiently over the entire waveband on which it is intended to carry out reception.

To a considerable extent the volume obtained from the Crusader will depend on the choice of a suitable transformer. If purity of reproduction

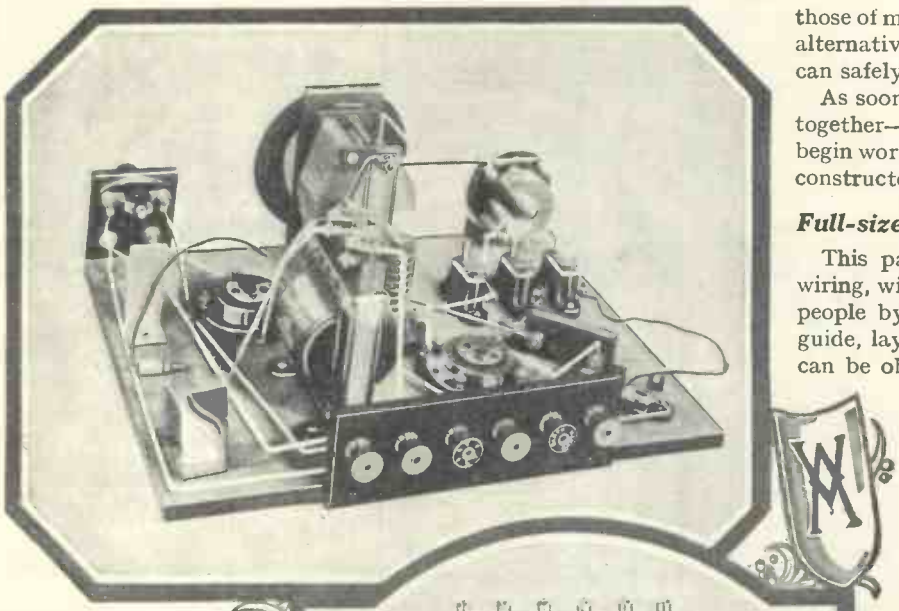


This layout and wiring diagram of the Crusader can be obtained for half-price (that is, 6d. post free) if the coupon on page iii of the cover is used before May 31

COMPONENTS REQUIRED

1—Wood baseboard, 12 in. by 9 in. (Picketts, Camco, or Ready Radio).
1—.0005-microfarad variable condenser (Bowyer-Lowe, Formo, or Raymond).
1—.0001-microfarad reaction condenser (Peto-Scott, Success, or Igranic).
1—On-off switch (Lotus, Lissen, or Bulgin).
3—Ebonite supports, two 2½ in. by 2 in. and one 4½ in. by 2 in. (Becol, Will Day, or Raymond).
1—Terminal strip, 6 in. by 2 in. (Becol, Will Day, or Raymond).
3—Single coil-holders (Lissen, Lotus or Magnum).
2—Anti-microphonic valve-holders (W. & B., Lotus, or Benjamin).
1—High-frequency choke (Wearite, Magnum, or Igranic).
1—.0003-microfarad fixed condenser, upright type (Lissen, Dubilier, or Marconiphone).
1—2-megohm grid leak with holder (Lissen, Dubilier, or Mullard).
1—Low-frequency transformer, ratio approx. 4 to 1 (Igranic, type F, Marconiphone Junior or B.T.H.).
1—Pair grid-bias battery clips (Deckorem).
8—Terminals, marked: Aerial, Earth, L.T.+, L.T.−, H.T.+2, H.T.+1, L.S.+, L.S.− (Eelex).
3—Short lengths flex (Lewcos).
2—Wander plugs, red and black (Clix) and spade tag.
3—2 ft. lengths insulated wire (Glazite).
1—Set of short-wave coils (Atlas or Igranic).
2—Tapped aerial coils, Nos. 60 and 150 (Atlas, Lissen, or Igranic).
2—Untapped coils, Nos. 50 and 100 (Atlas, Lissen, or Igranic).

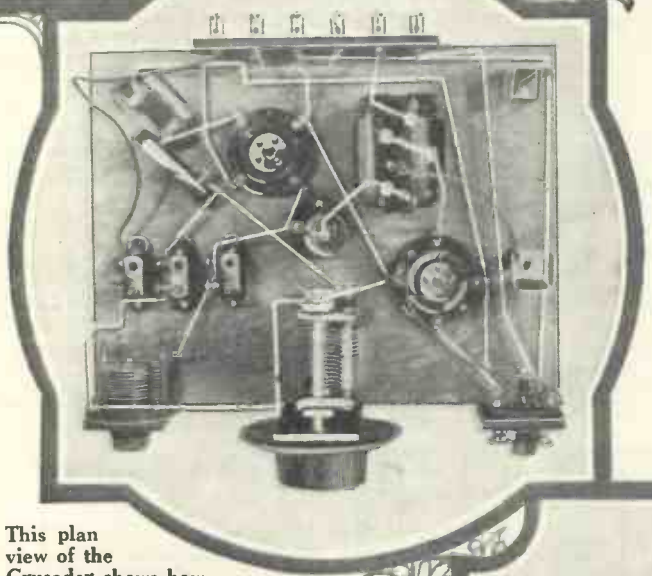
The Crusader (Continued)



The Crusader from the back

is the main consideration then a transformer of ratio not higher than 3½ or 4 to 1 should be used; if purity is not of principal importance a considerable increase in volume can be obtained by using a transformer with a ratio as high as 7½ to 1 if a low-impedance detector valve is employed in conjunction with it.

As far as possible, however—and this especially applies to beginners who have not yet been reading the WIRELESS MAGAZINE long enough to have learnt most of the ropes of the radio game—all constructors of the Crusader are urged to use identical components to those built into the original design.



This plan view of the Crusader shows how well spaced all the parts are

Novices Assured of Success

They have undergone test and we know quite definitely that if the original is copied exactly even the novice is assured of success and satisfaction with the Crusader right from the start.

On page 323 appears a list of all the components required. The names that appear first in the brackets are those of the manufacturers whose parts were used in the original set. The other names are those of manufacturers who make suitable alternatives that the WIRELESS MAGAZINE can safely recommend.

As soon as all the parts have been got together—and it is advisable never to begin work until this stage is reached—the constructor can lay out the receiver.

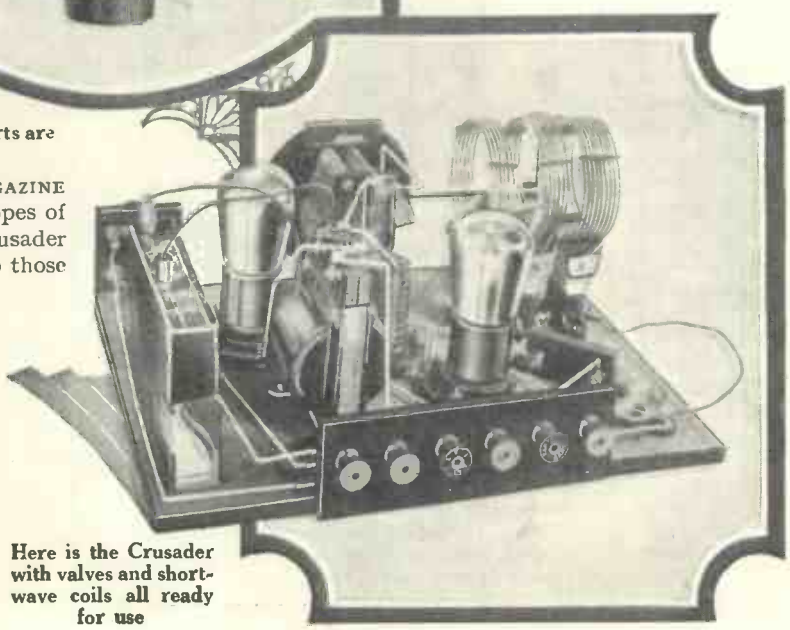
Full-size Blueprint Available

This part of the job, as well as the wiring, will be greatly facilitated for some people by the use of a full-size drilling guide, layout and wiring diagram, which can be obtained as a blueprint for half-price, that is, 6d. post free, if the coupon on page iii of the cover is used before May 31.

Address your inquiry to Blueprint Dept., WIRELESS MAGAZINE, 58/61 Fetter Lane, E.C.4, and ask for blueprint No. WM69, which will be posted off by return.

No difficulty will be experienced in laying out the receiver; all the parts are clearly indicated on the blueprint and in the reduced reproduction of this which appears on page 323. It will be observed that each terminal point is marked with a small letter of the alphabet; these letters indicate which points should be connected together and in what order.

For example, all those points marked *a* are first



Here is the Crusader with valves and short-wave coils all ready for use

A Two-valver Costing £2 - 15 - 0

connected together with one wire or as few wires as possible; then all those points marked *b* should be connected up; and so on through the alphabet.

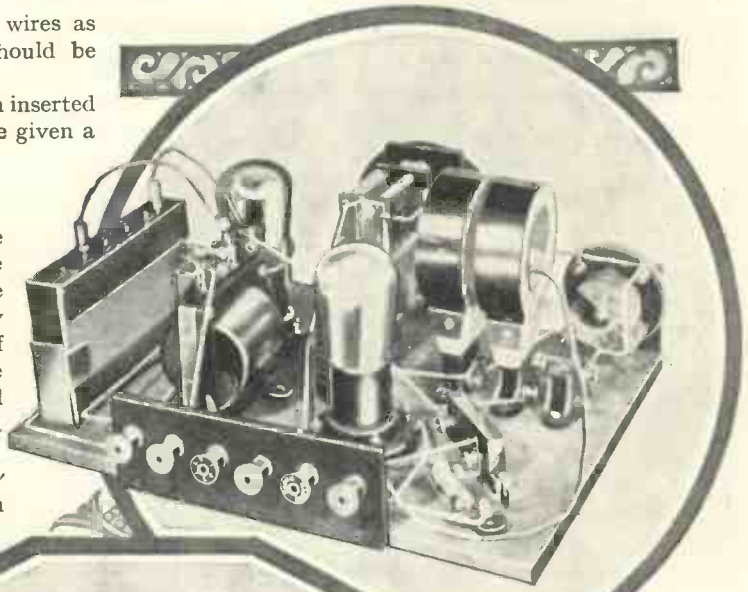
As soon as suitable coils and valves have been inserted in the appropriate holders the Crusader can be given a rough test.

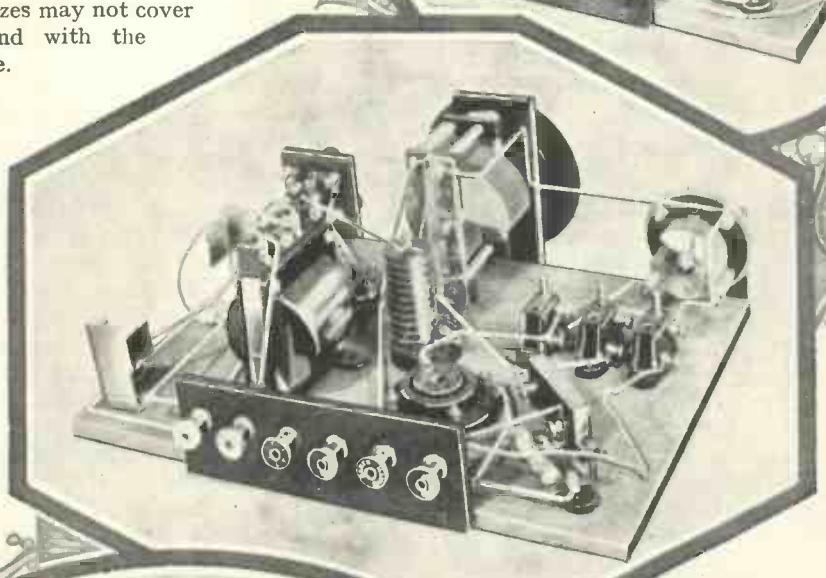
Choice of Suitable Valves and Coils

A list of suitable valves is reproduced on page 326, but it may be further noted that the detector valve should have an impedance of the order of 15,000 ohms, while the low-frequency amplifying valve should have an impedance of the order of 5,000 ohms or so. These values are very approximate and differences of several thousand ohms are permissible in making a choice.

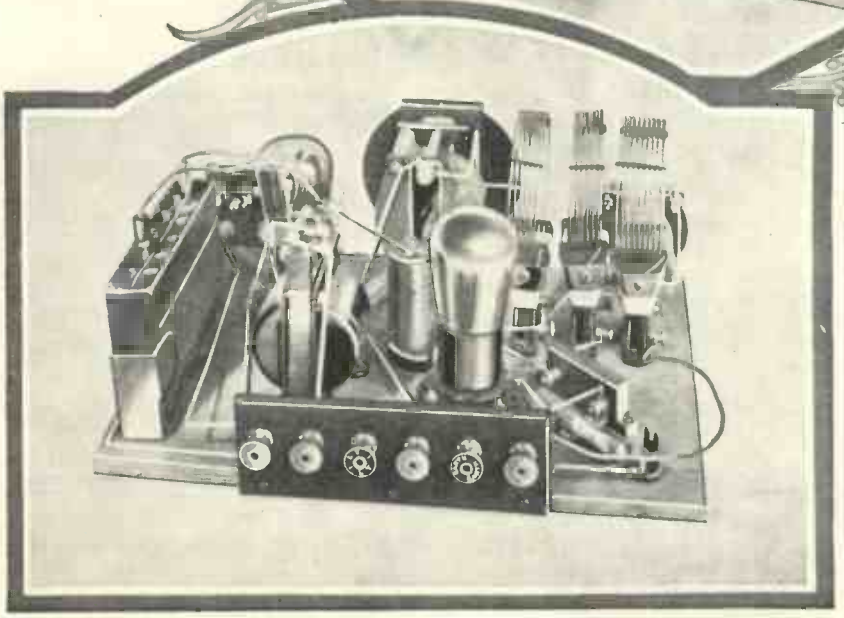
Suitable coils *for use with the average outdoor aerial* are indicated in the list of components on page 323, but these sizes may not cover the desired waveband with the particular aerial in use.

Remember that for reception on the ordinary broadcasting band of wavelengths only two coils are needed; these are a tapped aerial coil and a reaction coil. Either a centre- or double-tapped aerial coil can be used, depending upon the degree of selectivity required (a double-tapped coil is more selective than a centre-tapped coil) and usually the reaction coil can be a size smaller than the aerial coil. The coil-holder nearest the edge of the baseboard will not be used for reception on this band of wavelengths.





(Above): The Crusader ready for reception on the broadcasting band of wavelengths (Left): Another view of the Crusader showing the neat layout



Another view of the Crusader, all ready for use, with short-wave coils

For Short-Wave Work

For reception of the very short waves a set of special short-wave coils should be obtained, but in this case a very small aperiodic coupling coil should be inserted in the holder nearest the edge of the baseboard. The flexible lead soldered to the main aerial terminal will also be connected to one

The Crusader (Continued)

VALVES TO USE IN THE CRUSADER

Make.	Detector.		L.F. Amplifier.	
	2-volt.	6-volt.	2-volt.	6-volt.
B.T.H.	B210L	—	B215P	B4
Burndept ...	HL213	—	L235	L525
Cossor	210LF	610HF	220P	610FP
Cosmos	SP18G	DE50	SP18RR	SP50R
Ediswan ...	GP2	ES5LF	PV2	PV610
Marconi ...	HL210	DEL610	DEP215	DEP610
Mullard	PM1LF	PM5X	PM2	PM6
Osram	HL210	DEL610	DEP215	DEP610
Six-sixty ...	SS210LF	SS6075HF	SS215SP	SS610P

terminal of this holder and not to a tapping on the aerial coil as is the case for reception on the higher bands.

To test the set, push in the on-off switch, place valves and coils in position, and connect up the batteries and a pair of headphones or loud-speaker. To H.T.+1 apply about 60 to 80 volts and to H.T.+2 apply 120 volts or more. The grid-bias battery is mounted direct on the baseboard and should be so arranged that about 6 volts negative is applied to the grid of the amplifying valve.

Before tuning-in pull out the filament switch to put the set on and manipulate the reaction condenser until a slight rustling or hissing sound is heard which indicates that the set is "live." Now turn the knob of the main tuning condenser until a transmission is picked up.

Is your Wavemeter Accurate?

MOST people believe that a heterodyne wavemeter must necessarily be more accurate than one of the simple buzzer type. It would be more correct to say that an *accurate* heterodyne wavemeter gives more definite *readings* than a buzzer meter, but the latter is often more accurate than the former.

Not Much to Go Wrong

There is not much in the buzzer itself which can possibly go wrong, and provided that the coil and condenser are mechanically constant there is no reason why a buzzer meter should be inaccurate, or fail to maintain its setting. The trouble is that the buzzer note is not sharp enough to give a definite and easily-read tuning setting, for the "buzz" can be heard over a wide band of wavelengths.

In a valve-oscillator heterodyne meter, on the other hand, the tuning is sharp enough for all ordinary purposes, but the meter may lose its "tune." The principal cause of trouble is that battery values may alter, and so upset the reading obtained. If a new valve is substituted for the one with which the meter was first calibrated, re-calibration will be necessary.

The most that can be done to prevent battery values altering is to place very large fixed condensers across both the H.T. and L.T. input terminals. The condenser across the L.T. supply will not, of course, make up for a discharged accumulator! But it will compensate for temporary minute irregularities.

Particular attention should be paid to all contacts, for any dirt or looseness will upset current flow. Valve legs and sockets are particular offenders in this respect.

DO NOT OVERLOOK THE SPECIAL "GRAMO-RADIO" ARTICLE ON PAGE 314

No really accurate heterodyne meter is complete without H.T. volt and milliampere meters to show up any variations. (F. B.)

Are Mains-operated Receivers Risky?

"FAR too dangerous for me," says many an amateur when you mention the subject of H.T. from the mains. The kind of "danger" to which he refers is, of course, the danger of blowing mains fuses. From the point of view of the danger of burning out valves H.T. eliminators are safer than dry batteries or accumulators.

Small Maximum Current

This is the reason: The maximum current that an eliminator designed for a two- or three-valver can pass is about 15 to 20 milliamperes. This is not sufficient current to cause a dull-emitter to function, so "burning-out" is quite impossible.

H.T. dry batteries and, more particularly, H.T. accumulators can deliver a current of an ampere or so (for a very short period) and this current might do much damage, if ill-directed, before it dies down!

M. B.

All About Moving-coil Loud-speakers Next Month

Half Hours with the Professor

A CHAT ON PURITY

"DO you know, Professor," said young Amp one day in a meditative sort of way, "I believe this talk about purity is bunkum. I was at a concert the other day—Mum and Dad took me—and it was the first time I had heard any big orchestra playing."

"Did you enjoy it?" queried Megohm.

Different by Wireless

"Well, yes, I did in parts," was the reply. "I got fearfully bored with some of it, but there were other bits which I enjoyed quite a lot. But, funnily enough, they played a piece which I had heard on the wireless only the day before and it was quite different."

"It probably would be," said the Professor. "Shall I tell you just what differences you noticed?"

Amp eyed the Professor with his mouth open. "What do you mean, Professor?" he exclaimed. "How on earth can you tell me what I noticed?—unless of course, you were there yourself—but then I never told you where I had been."

Megohm smiled. "No, I was not there, but nevertheless, I can tell you the principal points which should have struck your attention. You noticed, first of all, I expect, that the strings—I mean the violins and violas—appeared to have quite a different quality. You probably noticed that there were several different kinds of instruments in the wood-wind, as it is called; the clarinet, oboe, and flute, for example, all of which had a distinctive quality of their own."

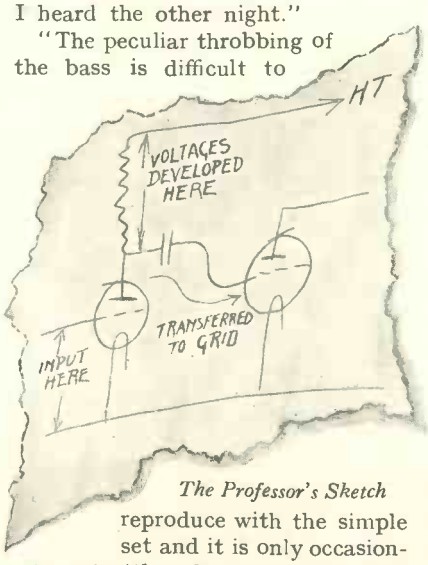
"New" Brass Instruments

He looked inquiringly at the Amp, who was standing there with an excited look in his eyes and as soon as the Professor ceased he burst forth: "Well, that's extraordinary. Those are the very things I was going to tell you—only not so poshly—and s'matter o' fact, there seemed to be an awful lot of big brass instruments that I had never heard of before.

"Exactly," agreed Megohm, "you would notice just that effect. Indeed, this aspect of the question is very often more striking than the other. As soon as the concert hall is entered one is conscious of an atmosphere entirely lacking in the ordinary set."

"In any set, I should think," interrupted the Amp, scornfully. "I have never heard a set which was a patch on the actual concert that I heard the other night."

"The peculiar throbbing of the bass is difficult to



The Professor's Sketch

reproduce with the simple set and it is only occasionally and with rather special sets that you obtain anything like this effect. It can be done, as I will show you presently, but with the average receiver it is not possible. We can differentiate, however, between various types of instruments on quite a simple receiver provided we take the trouble."

"You mean by the use of some special circuit?" queried the boy.

"By the use of forms of coupling which will reproduce with reasonable fidelity. Music is made up of fundamental notes and harmonics. If you play a note on a flute and the same note on a violin, the two will appear quite different. You can even obtain quite different qualities with the same instrument, such as a violin, according to how you play it. The fundamental note is the same in each case, but the quality is changed by the number and strength of the harmonics."

Harmonics Explained

"What's a harmonic, anyhow?" interrupted the boy.

"An harmonic is an oscillation or vibration occurring some definite number of times as fast as the fundamental. The simple harmonics are definite multiples of the fundamental, their vibration rates being 2, 3, 4, or more times as rapid. We also have overtones, which are non-integral multiples, intermediate between the actual harmonics, but which nevertheless bear a definite relation to the fundamentals."

The boy eyed Megohm a little doubtfully and seeing this, the Professor raised himself from his chair, and said, "Come over here and I will show you something."

He walked over to the corner of the laboratory, where there was a long instrument mounted in a metal case. This he switched on and connected a cone loud-speaker to the output terminals. Adjusting one or two dials, he produced a curious whistle from the loud-speaker.

Producing a Pure Note

"There," he remarked, "you have a pure note."

The boy looked at the instrument in surprise and then looked back at the Professor. "A pure note did you say?" he exclaimed incredulously, "Why, it sounds the funniest sort of noise I have ever heard."

"It probably does sound funny because there are precious few instruments which produce a pure note. Nearly every note has harmonics.

Half Hours With the Professor *(Continued)*

Now I can introduce harmonics into this oscillator without altering the frequency of the note," and here he proceeded to make certain alterations. The boy listened in amazement as the character of the note changed at each adjustment. At one moment it sounded like a violin, at another like a clarinet, yet all the time the note itself remained the same.

Changing the Quality

"I won't bother you," said Megohm, as he smilingly shut off the oscillator, "by telling you exactly what I was doing in each case, you but will see that by introducing harmonics I could change the quality of the note altogether. That is what you have to look after in a wireless set. In order to do that you have to arrange to amplify all frequencies to the same extent and this is very difficult to do."

"What sort of frequencies do we have to use then?" asked young Amp, by now thoroughly interested.

"The full audible range extends from about 25 or 30 cycles per second up to 10,000 cycles per second, which is an enormous range to cover and very difficult of attainment. An average horn loud-speaker will not reproduce frequencies much below 200 cycles per second—that is to say, that it will not radiate them properly, although you can hear them if that frequency only is applied to the instrument."

"How do you mean?" broke in the boy.

Lost in the Rush

"I mean that if you applied a frequency of 50 cycles to an ordinary horn loud-speaker, you would hear a note, but if you played some music in which some 50-cycle frequency was included, the loud-speaker would not give the 50-cycle note in true proportion and it would be practically entirely lost behind the other music. Is that clear?"

The boy nodded. "How much is 50 cycles, anyhow?" he asked.

"Two octaves below middle C is 56 cycles," was the reply. "To resume, it is clear that with the average horn loud-speaker, there is little point in reproducing frequencies much below 200 cycles, and the ordinary transformer-coupled set doesn't.

We can, however, obtain greater faithfulness if the upper frequencies are corrrectly amplified. A poor transformer will commence to fall off in its amplification at 2,000 or 3,000 cycles per second, which means that the high harmonics are not correctly reproduced. It is these which will give the distinctive quality to the different instruments."

"Well," said the boy, "what about resistance-coupling?"

"I was coming to that," answered Megohm. "We can obtain the quality we want either by increasing

DON'T FORGET THAT YOU CAN OBTAIN A FULL-SIZE BLUEPRINT OF ANY ONE SET OF WHICH THE CONSTRUCTION IS DESCRIBED IN THIS ISSUE FOR HALF-PRICE BY USING THE COUPON ON PAGE iii OF COVER BEFORE MAY 31.

the qualities of the transformer, which usually means making a very much more expensive instrument or, alternatively, by using resistance or choke coupling. With resistance-capacity coupling, we have a resistance in the anode circuit of the valve. Since the value of this resistance is constant, irrespective of the frequency, the amplification from the valve should be constant also at all frequencies."

"Why do you say 'should be?' It is constant, isn't it?"

"No, there are two effects which prevent it from being constant. The first of these is the fact that the voltages developed across the resistance have to be transferred to the next valve through a coupling condenser. See," he continued, seizing a piece of paper and drawing the rough sketch reproduced on page 327. "We apply a voltage across the grid and filament of the valve and this causes varying currents to flow in the anode circuit. These varying currents in turn produce voltages across the resistance which are then transferred to the grid of the next valve.

"We do not wish to transfer the steady high positive potential from the high-tension battery, however, because this would polarise the grid of the next valve and make it refuse to work. So we isolate the second valve as far as steady currents are concerned by inserting a large condenser. At the low frequencies, however, the impedance of this condenser becomes appreciable, and there is a cut-off produced due to this effect. In average use, however, this cut-off is not important."

"What sort of values do you want then, Professor?" asked the lad.

Values of Resistances

"It depends upon the resistances," was the reply. "Here," he continued scribbling some figures on the bottom of the paper. "These are some suitable values for you, so take this paper and keep it. (See diagrams on opposite page.)

"You notice," he resumed, "that I have not included any very high values of anode resistance. It has been found that using very high values the capacity across the resistance begins to take effect much too early. There is always some capacity effect and this begins to cut off the very high frequencies or overtones which we are anxious to preserve. Consequently, we must limit the value of the resistance in order that this cut-off effect does not become serious within the audible range."

"Then, I suppose, it is also important to avoid capacity in the circuit as far as possible?"

"Yes, you should wire your circuit carefully in order to avoid any capacity across the anode resistance and also you should use a low-capacity resistance. The maximum value satisfactory for really good quality is about 250,000 ohms, as I have given."

Ideal Form of Coupling?

"Well, then, resistance coupling seems to be the ideal form of coupling."

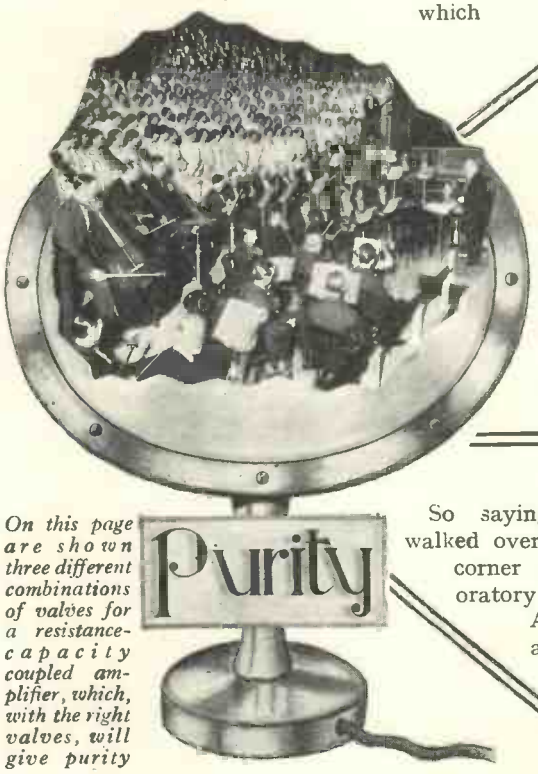
"It certainly has many advantages, but I do not know that I should quite agree with that statement. There are, unfortunately, other factors to be considered, the principal one being the drop in H.T. due to the presence of the resistance in the anode circuit. There is always a voltage drop produced across the anode resistance by

A Chat on Purity of Reproduction

the steady anode current so that the voltage actually on the anode is always less than the applied H.T. voltage.

"It is necessary, in order to obtain reasonable amplification of the valve that the anode resistance should be two or three times as great as the valve resistance, which means that the valve itself only has about one-quarter of the full voltage applied actually to the anode."

"Oh, good heavens," exclaimed the boy. "That's rather a blow, isn't it? I mean, what's the good of wasting all the H.T. before you use it?"

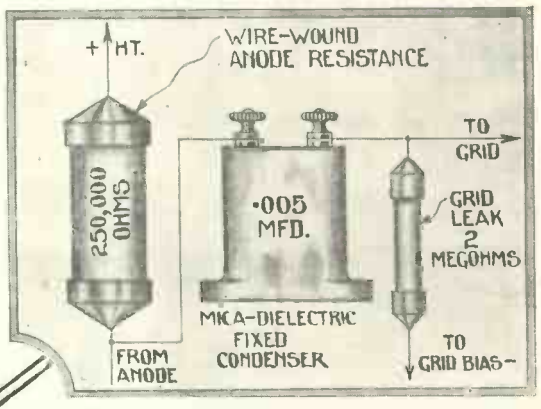


On this page are shown three different combinations of valves for a resistance-capacity coupled amplifier, which, with the right valves, will give purity

"That is the most serious objection to resistance-coupling and there is no remedy for it. In the early stages of an amplifier we can afford to cut down the H.T. and work with an actual value of 20 or 30 volts only on the anode, but in the later stages we cannot afford this and we must either cut down the anode resistance considerably and lose a large percentage of the amplification or we must increase the H.T. so that the voltage applied to the anode is of the order of 100 or 120 volts."

"But lots of people swear by resistance coupling, don't they, Professor?" Amp asked after a pause.

"There is quite a lot to swear by in it," answered Megohm, "but it is limited when it comes to handling fairly large volume and consequently in the later stages of a receiver it is becoming customary to use different forms of coupling which give a characteristic nearly, if not quite as satisfactory, without the serious disadvantage of loss of H.T. voltage. Perhaps some day I will tell you the way this is done, but you shall judge for yourself of the results."

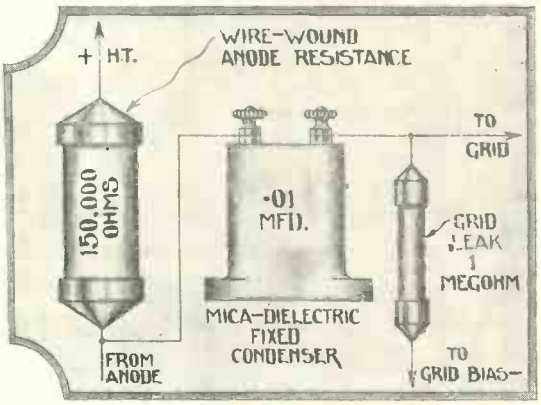


So saying, Megohm walked over to another corner of the laboratory where the Amp saw to his delight a bench model receiver. "There is some excellent music just about to be broadcast now," said the Professor, "in fact, it has probably started."

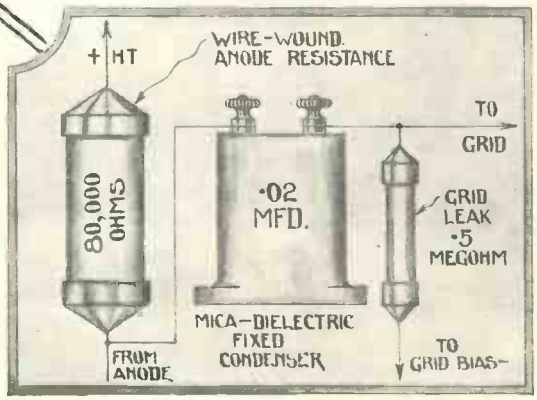
As he said this he pressed a switch and the orchestra was heard clearly and with accurate definition of every instrument.

Neither spoke for some time. Finally the boy said: "But this is witchcraft. Why, it wasn't any better than this when I heard it at the concert itself."

"I thought you would say that," smiled Megohm. "Can't you hear the boom of the bass? Look," he said, "put your hands on the table here. You can feel the drumming of those double-basses and yet all the time we haven't lost those upper harmonics and overtones."



Again there was a silence until finally the Professor said: "Well, I'll tell you how to do it one of these days, but you must run along now, because I have got to go out for a few minutes," and with these words he bundled the sadly distracted youth out of the laboratory.



A Revised Fable with a Moral for Experimenters

The Artifice That Met With Ill-success

IN the Golden Annals it is *written* that in the Sixth Year of the Glorious Reign of the Almighty Caliph *Rah-dee-oh* (Peace be with him!) there *dwelt* in the City of Saa-voy an Aged Merchant, one Hassan-Ben-Azra, who for *many* Moons had Honourably dealt in Costly Wares *and* Merchandise of Great Rarity.

It is said that he was Honoured and Respected by all his Customers in the *Bezestein**; by Virtue of his Simple Honesty he *had* acquired a great number of Friends, but had also *made* jealous Enemies.

Now it came to pass that on one Fateful Day there arrived in this City a Pedlar who had travelled great Distances *and* who, albeit his poor Appearance and ungainly Carriage, *did* speak in a pleasant Manner and with all the Attributes *of* polite learning. Whereupon, in the Bazaars, as it hath already been *related* elsewhere, did *he* sell Magic Crystals in richly ornamented Caskets of sweet-smelling Wood by which the Faithful were enabled to hear the *distant* Voice of the Muezzin from the Threshold of their Abodes.

And the Aged, but Honest, Merchant, wilfully misguided by the wrongful *Counsel* of Treacherous Rivals, did *pay* the Pedlar many Thousand Pieces of Gold in exchange *of* which he was given a Quantity of these Devices with the Assurance that he would by this means amass untold Riches.

And Hassan-Ben-Azra, mindful of *these* Promises, did *travel* widely throughout the Realms of the Caliph, and did visit *many* Large Cities to sell his Goods. But albeit he *was* of Venerable Appearance, and *enjoyed* High Repute, his Wares did not meet *with* Favour in the Eyes of the People.

"For," said the Merchants unto him, "of Magic Crystals have we *seen* Countless Numbers in the Past; thy advanced Years have bedimmed *thy* Wits. In the Bazaars can *we* show thee Magic Lamps which, by *their* Virtue, will encompass greater Wonders."

It is *even* said that they counselled him to betake Himself and his Merchandise to less congenial Climes, the *which*, in those Days of Peace, was judged to be a cruelly malicious Invitation. Now, Hassan-Ben-Azra was justly disappointed with the Ill-success of *his* Enterprise, and after Long *and* Weary Journeyings, fraught with unpleasant Adventures, he did return to his Native City.

It is related that this Aged Merchant possessed a Son to *whom* he had given the Name of *Selim*, which meaneth *He who hath Brain Waves by Night*, and who was greatly Distressed *at* the Grief *his* Father showed when recounting his Misfortunes in the Bosom *of* his Family. On one Morning, Selim addressed him thus:

"O Father, in *your* Great Wisdom, you have given me many Opportunities to acquire Learning from the *Wise Men* of our Land, and *I* have profited thereby; from my Masters I have gained *all* the Knowledge which befitteth a Successful Merchant. I conjure you to take me *into* your Business that I may relieve your *last* Years of Grievous and Onerous Troubles."

To which Hassan-Ben-Azra did *make* reply:—

"As my Father did unto *me*, so will *I* act towards thee, my Son. If thou wilt prove worthy of *my* Trust, so will I *agree* to thy Proposal."

Selim, overjoyed at the Prospect of showing his Ability to recoup his Father's Losses, did explain the Stratagem *he* had devised in the *Night* Hours, and by which the Magic Crystals could be Sold without Delay *for* a good Profit.

"To-morrow," said he, "I will rise *betimes*, and betake myself with two Slaves to the Street *in* which the Merchants dwell. *There* will I give to each Thirteen of *these* Carved Boxes, *saying* to them that for these *Twelve* Magic Devices I shall demand *Twelve* Pieces of Gold."

But Hassan-Ben-Azra, at these words, did show his anger.

"Thou Dolt," he cried, "*wherefore* speakest thou of *Twelve*, when thy Slaves leave *Thirteen* at the Shops of the Merchants?"

And Selim (*He that hath Brain Waves by Night*) did droop his *left* Eye as he answered: "O Father, do you not *see* my Cunning? These Merchants, who have ill-advised *you* in this Venture, in *their* Greed, will buy the *Thirteen* Crystals, for they will believe that *I* have misjudged the Number of *Twelve*; they will all pay me the *Twelve* Pieces of Gold."

And it is related that Hassan-Ben-Azra *was* doubtful of the Stratagem, but that he enjoyed the *Thought* that Selim had Profited *by* his Teachings.

"If thou *dost* Succeed," he said unto him, "then will I *take* thee into my Business."

And so it *came* to pass that, at Break of Day, Selim, with all the Confidence which Youth *doth* Possess, set forth from his Father's Abode, accompanied by Two Slaves *and* his Wares, and did visit the Bazaar, as he had promised *to* his Parent. *And* he did leave with each Merchant, *Thirteen* Magic Crystals encased in *richly* Carved Boxes of Sandalwood. *Also*, it is said, he *did* give unto them, in his *own* Hand, a Tablet on which was written that *for* the *Twelve* Crystals he did demand *Twelve* Pieces of Gold.

On his return to *his* Dwelling, Selim passed the next Day in Great Impatience; for, as he said to his Father: "I have put *you* in the Way to sell your Merchandise. As you have *promised* me, so shall I *share* your Losses and *your* Profits.

But, on the following Morn, of the Wily Merchants in the Bazaars, without exception, each returned *Twelve* Crystals with the Tablet written by Selim, saying unto him:—

"It *is* in vain we have sent Criers throughout the Streets of *this* City of *Saa-voy*; the Faithful will *not* buy these Wares.

And both Selim and Hassan-Ben-Azra *did* shed Tears of Disappointment as they saw the Crystals returned to *their* Abode; for it was made clear unto them that *each* one of their jealous Rivals *had* retained *one* Magic Box, for which he had *not* paid.

Moral: *It is easiest to learn at another's cost.*

J. GODCHAUX ABRAHAMS.

* *Note by the Translator.*—The market square on which all merchandise was exposed for sale.

An Article of Interest to Every Valve-set Owner, by R. W. Hallows

How a Modern Valve is Made

THE valve as we see it when it comes out of its box looks a simple enough affair. There is a glass bulb, usually "silvered" on the inside, a cap and four pins. Inside the bulb, though the "silvering" often prevents us from seeing them clearly, we know that there are filament, grid, and plate.

Round an Up-to-date Works

But to make up a valve worthy of the name entails the employment of the most skilled human hands and of machinery so ingenious that it is almost uncanny in its action. I had seen valves being made in the old bright-emitter days, when the majority of the work was done by hand, but until a month ago I had not had the opportunity of going round an up-to-date works organised for mass production.

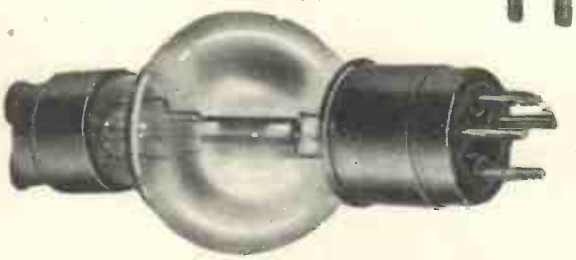
When a well-known firm of valve manufacturers were kind enough to invite me to spend a morning at their factory, the opportunity was clearly one not to be missed and I have seldom had a more interesting experience.

Speaking broadly, the valve passes through seven main processes before, labelled and boxed, it finds its way on to the shelves of the store house, ready for issue to the dealer in wireless supplies. These processes are: (1) Making of the "foot," (2) assembly of the electrodes, (3) sealing into the bulb, (4) pumping, (5) capping, (6) eddy currenting, and (7) final testing. Actually each of these stages in its construction involves a considerable number of steps of which we shall see more in a moment.

Breaking Open a Valve

If you break open an old valve, as you may easily do by placing it under water and tapping the glass gently, you will find that the electrodes are mounted upon a kind of pedestal made of hollow glass. This is known as the foot, and the top portion of it, into which the electrodes and their supports are sealed, is called the pinch, for the very good reason that it actually is pinched flat in order to grip the various wires.

The foot starts life as part of a glass tube several feet in length. A machine whose foundation is a turntable is loaded with these lengths of tubing just as a slot machine is loaded with bars of chocolate. When the machine is started, the protruding end of the first length of tubing is brought into a gas flame. Having remained here for the necessary number of seconds, it is automatically moved on to a second somewhat hotter flame.



Two examples of valves with indirectly heated cathodes, for working from electric light mains. That on the right is the type made by Marconi and Osram, while that below is a Cossor

Meantime, of course, the next length of tubing is introduced to the first gas flame and so on. Having been further heated, the first tube moves on again and at this stage a flange is automatically made at its end. It continues its journey round the turntable, being annealed and shaped in the various stages through which it passes.

Finishing Off the Foot

The exact length required is measured off automatically and when it reaches the last stage two revolving knives, one inside it and one out, come into play and cut off the finished foot. As the inside knife drops down, having finished its work, a puff of air comes through a tube and blows the now completed foot gently into a basket that is waiting to receive it.

The modern valve factory is so arranged that during the process of manufacture the valve starts at one end, passes in its various stages through the room and finally comes out at the other end complete and ready for service. All machines, too, are carefully regulated as regards their speed, so that the supply of valves in any particular state is always equal to the demand by those ready to carry out the next process.

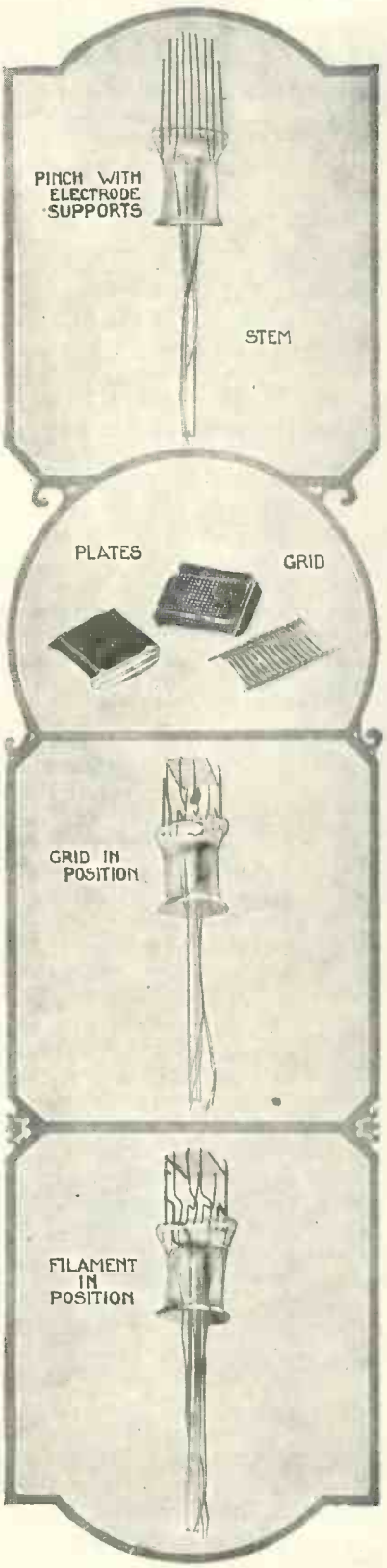
Electrode-supporting Wires

From the foot-making machine we pass to the bench, where the electrode supporting wires and the little glass tube necessary for pumping out the valve are placed within the glass. Special jigs secure dead-accurate positioning. The foot with its wires and tube travels round another turntable upon which the glass is heated once more and finally given by a pair of metal jaws a pinch which seals everything firmly into place.

Whilst the glass is hot and soft, a

All You Want to Know About Moving-coil Loud-speakers in the Next Issue

How a Modern Valve is Made *(Continued)*



Parts of a Mullard Valve

blast of air is blown through the sealed-in tube, causing a little hole to appear just below the pinch. Through this hole and the tube, all the gases within the bulb will be extracted later.

At the Assembly Bench

Next we came to the assembly bench at which sat workers provided with supplies of the various small pieces which go to make up the electrodes. It is surprising really to notice how many of these little parts there are—the filament, the grid itself with its stout wire former, the plate, the top insulator, and the tiny spring with a hooked end which stretches the filament into a V shape. All of these parts are made at separate benches and brought across to that devoted to assembly.

One of the most delightful processes is that involved in grid making. The operator has in front of her a supply of wire formers and a machine containing a mandril with a reel of fine molybdenum wire. The former is placed on the mandril and one end of the reel of wire is hooked under a little catch. The mandril spins round, winding on the turns of wire with perfect spacing. This done, the operator draws a lever with her right hand, causing an electric spot-welder to travel over the windings. Each individual turn is thus welded to the stout wire of the former.

From One End to the Other

But to return to the assembly bench, which is so arranged that the work travels from one end of it to the other. At the input end is an operator who welds the ends of the filament to their supports. From her the foot passes to a colleague who welds on the grid. It next travels down a sloping slide across the bench to a pair of operators who between them nip off the end of the grid-former, place the seonite insulator in position, insert the spring and pass the filament over its little hook. At this stage the electrodes are carefully examined to see that they occupy exactly their proper positions.

Another slide takes the valve further on its zigzag course to the operator who welds on the anode supports. Across the bench once more it travels for the final process of assembly. The anode is slipped on and spot-welded and a small piece of magnesium wire is welded to it.

So much for the foot and the electrodes mounted upon it. Meantime supplies of bulbs will be under treatment at another bench where they are washed and afterwards dried by warm air blown into them through pipes. Bulbs and complete feet meet one another for the first time at the sealing machine, again a turntable, upon which several processes are carried out automatically.

The foot is placed within the bulb and a flame plays upon both. Step by step the glass is annealed and brought up to the required heat. In the final stage a perfect union between the foot and the bulb is effected and the lower unwanted part of the latter is cut off by a hot flame.

Ready for Pumping

The valve is now ready for pumping. Once more it is placed on a turntable of a particularly ingenious kind. As it travels round the electrical contacts necessary for bombarding the anode are made automatically. Meantime wonderful pumps are at work extracting every possible atom of gas from within the bulb. In the final stage upon this turntable heat is applied to the small tube in the foot. Air pressure causes this to collapse as it softens, forming a pip. In old-fashioned valves, the pip was always at the top of the bulb; in nearly all of those made to-day it is hidden within the cap.

Use of Magnesium

Possibly the reader has been wondering why a small piece of magnesium should have been welded to the anode in an earlier process. The reason is this: To all of the metal parts within the bulb clings a minute quantity of gas which cannot be extracted by any straightforward process of pumping. Were these occluded gases, as they are called, allowed to remain, they would be given off when the internal parts of the valve heated up in use. There would thus be a softening of the vacuum and the valve would become useless, at any rate for amplifying purposes.

Every Valve-set Owner Should Read This Article

During the first bombardment, which is accomplished by lighting up the filament and applying a high voltage to the anode, the latter becomes red hot and gives out part of its occluded gases which are extracted by the pumps. The heat also causes part of the magnesium to volatilise.

Gases Taken Up

When this happens the atoms of the metal collect gas atoms which they carry with them to the glass walls. The gases are thus occluded now by the metallic deposit within the bulb, and since in a dull-emitter this never becomes hot, there is no fear of their being subsequently released. Not all of the magnesium is, however, used up in this process. It has still a part to play as we shall see later.

The next journey is to the capping bench, where I witnessed a marvellous display of dexterity on the part of an operator. From the lower end of the foot there protrude the four wires which form the connections to plate, grid, and the two ends of the filament. The valve pins are hollow, one of the wires having to be passed through each. The operator in question worked so rapidly that movements of her fingers could hardly be followed.

In a moment she had straightened out, scraped and cut to their proper length the four wires. Seizing a cap, she threaded the four simultaneously through their proper pins. Imagine threading four needles at once and you will have some idea of the astonishing skill involved.

Trying My Hand!

Wondering what sort of show I should make, I asked to be allowed to try my hand. The operator performed the entire process in two or three seconds; at the end of five strenuous minutes I was forced to own myself beaten!

Pressed into its cap the valve travels round the turntable of a baking machine which hardens up the cement securing the bulb in position. The wires passed through their pins are not yet soldered, for if this were done, any defect found at a later stage would mean that both the bulb and the cap had to be scrapped. The wires then are merely laid round the outsides of the pins.

Now comes a particularly interesting process. The valve is placed in a holder upon a very large turntable beneath which are automatic electrical contacts which pass to each the current necessary for ageing the filament. At one point on the turntable is a spiral of stout wire which falls overthe valve,and remains embracing it for some seconds and then rises to pass on to the next. This coil carries high-frequency current supplied by a huge tube.

Eddy Currents in the Metal

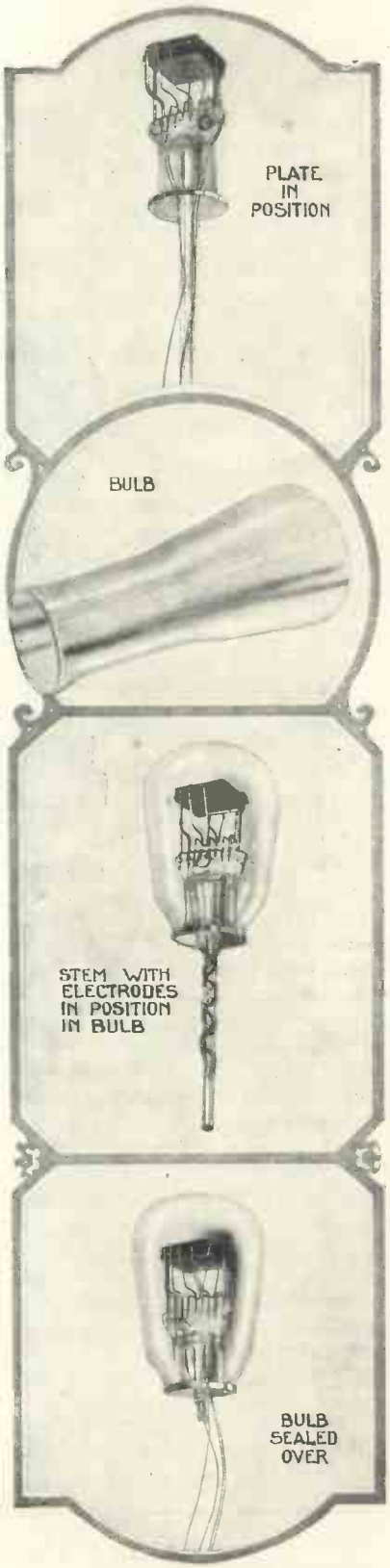
As the valve is encircled by the coil, eddy currents are set up in the metal parts within, causing them to become heated up until they glow brightly. The last of the occluded gases are thus driven off, and when the heat reaches a certain point, the remainder of the magnesium volatilises and takes charge of them.

Almost completed now, the valve is ready to have its characteristics tested. It passes to a most ingenious instrument in charge of a skilled operator. When it has been placed in the holder upon the instrument one movement of a switch causes meters to record the filament voltage, the filament current and the plate current at a given voltage with the grid at zero potential. A second movement increases the plate potential, leaving the grid still unbiased.

Further Stringent Tests

We thus have points on two characteristics corresponding to different plate potentials. Should the valve fail to show almost exactly standard readings it is rejected as faulty. But the stringent test is by no means complete. A third movement of the switch applies a negative grid bias of a certain definite amount, leaving the plate potential at the higher value.

If the magnification factor of the valve is correct, the plate current should now be the same as it was with the lower plate potential and the grid unbiased. Lastly, the plate and grid are connected together by a fourth turn of the switch and the total emission of the valve is read off. The whole operation was completed in a matter of seconds, but



More parts of a Mullard Valve

How a Modern Valve is Made *(Continued)*

it provides a most searching and reliable test.

With Flying Colours

When it comes through this test with flying colours the valve passes to an operator who nips off the ends of the wires protruding from the pins and presses the ends of the pins first on to a pad moistened with flux and then into a shallow dish of solder kept molten by an electric heater.

But it has still two further tests to go through before it can be passed into store. In the first of these the hardness of the vacuum is tried, no valve being passed which shows any trace of softness. Next the insulation must be thoroughly tested. It may be imagined that when the magnesium getter volatilises a little of the metal may be deposited upon the pinch, thus forming high resistance leakage paths between the electrode supports. Were it allowed to remain the valve would "play up" when in use in all kinds of queer ways.

This magnesium is got rid of by a process of burning off. The valve having been placed in a holder, very high potentials are applied first between plate and grid, then between plate and filament and lastly between filament and grid. These cause all traces of metallic deposit upon the pinch to disappear.

Tested by Megger

Having been treated in this way the valve is tested by megger for leakages between any of the three electrodes. None is passed for sale unless infinite resistance is shown between these points.

All that remains is to gum the identifying label on to the bulb and to pack the now completed valve in its cardboard box. This last process was to me one of the most astonishing of all. The cardboard boxes now used are supplied by their makers folded flat. To assemble them they must be pressed with the fingers into square shape and three flaps must be folded in at the bottom. When the valve has been placed within the box three more flaps have to be folded over at the top of it.

Only a few days before my visit to the valve works I had tackled the job of setting up a couple of these boxes from the flat and placing valves within them. I do not know quite how long it took—certainly several minutes for each and when the job was done the box did not look particularly neat. Noticing, therefore, an operator with a pile of boxes in the flat beside her, I did not envy her her work. When I first saw her, she was resting for a few moments when suddenly she got to work again. In three seconds the flat box was square with all its three lower flaps folded in as neatly as they could possibly be. A valve was inserted, its accompanying printed slip folded in and placed above it and the three flaps at the top of the box folded down, before I had time to gasp.

Another type of mains valve—that made by Cosmos

The operator simply seemed to wave her hands over it, and the box erected and folded itself in some magic way, the entire process from start to finish being accomplished in about ten seconds.

Lastly, the valve passes into the great store when, in company with vast numbers of all kinds, it waits ready for the day when it will be called upon to bring in speech and music from distant stations in your receiving set—or mine.

Pressing the Crystal for good Results!

UNTIL experts succeed in finding out how and why a crystal detector works, the reason why some crystals like a firm catwhisker pressure, and others a light contact, will remain a mystery. This catwhisker pressure business is, nevertheless, important.

Firm Pressure Needed

Those who have been converted to the advantages of carborundum (using a small applied potential) will be able to affirm that, although the chief merit of carborundum is its constancy of operation, a constant, firm pressure between the crystal and the steel contact must be maintained.

Upsetting Characteristic

Apart from the fact that a constant pressure is needed on all crystals, if they are to detect satisfactorily, there is a further reason why constancy of pressure is essential with carborundum. Any variation of contact will alter the extremely minute current flowing through the crystal (this current, is, of course, the result of the potential applied) and so upset its characteristics.

Coarse and Fine Grains

In the case of galena-type crystals —and many commercial detectors are in the galena series—a firm pressure seems to work best with a coarse-grained crystal. Crystals of lighter grain require a somewhat lighter pressure.

Some spots on a crystal do not appear to be sensitive until a fairly heavy pressure is applied by the catwhisker point, while other areas do not detect at all if more than the lightest possible contact is made.

B. I. M.

Don't Overlook the Crusader—on Page 322!

PREPARING A BROADCAST

By Frank Rogers

On the left is seen Miss Norah Blaney at the piano, and above are the masts of the London station.

IF the B.B.C. were to broadcast a request that all listeners wrote out and submitted their own estimate of the amount of work required to bring one evening's programme to fruition, the response, supposing there was one, would generally admit that some work was necessary, but would undoubtedly fail to take into account many of the stages through which every item has to be piloted.

Minimum of Six Weeks

If a programme could be built up, rehearsed, and put on without a single hitch, six weeks would be required to complete the process. As it is, so many unexpected difficulties arise that this time limit is often exceeded.

In the first place it is obviously necessary to introduce new artistes from time to time, every one of whom has to be given an audition before he can be engaged. There are only seven studios at Savoy Hill, and the result of having so many calls upon them is that they have to be reserved three weeks in advance for both auditions and rehearsals.

Furthermore, since there are many parties doing the same kind of work, it does not always follow that it is possible to reserve just that studio which is best suited to the nature of the turn.

A good story of auditions was once told me by Tommy Handley. It concerns his own introduction to the microphone, and is so good that I wonder he has not broadcast it before now. As he braced himself for his ordeal he was quite naturally feeling decidedly nervous.

"When you have finished your song, Mr. Handley, I wonder if you would be good enough to say something funny. You know what I mean, don't you? You know,—er, —er, something, —er, well, something funny you know?" smilingly asked the official in charge.

Unfortunately Mr. Handley far from knew, and when the dread moment arrived was dumb for several seconds. At length the poetic muse within him welled up, and quite unconsciously he burst forth with:

Thirty days hath September, April,
June and November,
All the rest have thirty one, excepting February alone.

In the nervous collapse which followed, he thought he had "torn it," as he said afterwards. In actual fact, however, he had unknowingly made a singularly brilliant response to the request to say "something funny," and there was no question about his engagement.

A simple instance like this shows the nature of these auditions. Imagine, then, the official, having booked the studio for, say, fifteen minutes, anxiously endeavouring in that short time to discover the suitability or otherwise of his nervous charge.

After the artiste has been engaged the nature of his number has to be settled, and, of course, the date of his appearance. When a provisional day has been arranged, a note is made of it on the skeleton programme, which is never less than six weeks ahead, and often three or four months. Care must be taken that popular songs do not occur too frequently, and that the programme avoids that dreadful complaint, "sameness."

Rehearsal!

The next move is rehearsal, which progresses in much the same way as might be expected; those who have had any experience of amateur theatricals will need little enlightenment on this subject!

Before actual radiation takes place, however, many unforeseen things may happen; items which were considered certainties may have to be scrapped, while others, which were ruled out as impracticable, or possibly not even thought of, suddenly present themselves.

To cope with such emergencies it has been found necessary to provide a special programme "reference library" at 2LO, a room to which anyone may repair when in doubt as

Preparing a Broadcast (Continued)

to the proposed item for any station at any hour of the day during the ensuing three weeks.

All around the walls of the room are twenty-one wooden frames, roughly two feet square. Each represents one day's radiation, and as they are always full, the time covered remains constant at three weeks. As a day passes, so one frame is emptied and immediately refilled. They are divided into as many horizontal rows as there are stations, and the length from left to right represents the whole of the broadcasting day, thus allowing two inches or so per hour.

A Colour for Each Station

The rows are so constructed that a piece of fairly stiff card may be fitted in quite easily. Every station has been allotted its own distinct colour, and the origin of each item of the programme, whether its own studio, another or an outside hall, is indicated by the colour of the piece of card. A few brief informatory words of description are written on, and it is cut to a width proportionate to the time limit. For an S.B. or a relay another special colour is employed. One great advantage of this card system is that alterations can be easily made.

Often a station will suddenly find itself unable to give an item, and headquarters will be invited to suggest an alternative. By a simple visit to this reference library, details can be obtained of the whole day's radiation throughout the whole country, and perhaps a substitute found in another programme.

Special Items for S.B.

On the other hand, it may happen that a station director suddenly and somewhat unexpectedly discovers that he can provide an item of outstanding interest, a "red-hot" topical talk for instance. Its nature may render impossible a repetition, and he may consider it of sufficient importance to merit an S.B. He at once communicates with Savoy Hill, and again, one glance at the charts shows how many stations are free to take an S.B., or possibly suggests a time better suited to this purpose.

When the day of radiation arrives there still remains a considerable amount of administrative work to be done. Perhaps it is not generally known that there are always two announcers on duty, the senior of whom is in complete charge of the entire programme. Any decisions regarding alterations and so on are made at his direction, and he is far more than a mere mouthpiece, this being, in point of fact, a part of his work rather than his whole duty.

If a telephone message is received to the effect that a certain artiste is ill, it is the announcer who decides how his amount of programme time shall be filled. If a relay is coming through from Sydney, he is listening in the whole time, and should the quality of the transmission deteriorate seriously, the question of cutting it off rests on him.

Announcer's Log Book

Naturally he will consult the Control Room upstairs, but nominally the responsibility is his alone. This is not all; before he leaves the building that night, he must enter up a report of the day's radiation in his log book, which is taken as his evidence whenever an enquiry is held.

During the course of the day the performance moves from studio to studio according to the nature of the number, some needing a large room, and others a more intimate one. On entering a fresh studio the announcer at once gives the O.K. signal to the Control Room, which accordingly switches the microphone over, automatically lighting up a red lamp in the studio, and another over the outside of the door.

Recently, too, a third lamp has been placed in the corridor immediately overhead. It was noticed that people hurrying to and fro shook the ceiling, and so interfered with the transmission. The new lamp warns them to tread softly.

Another Innovation

Another innovation which has been brought about is the installation of a pianist in the new studio, No. 6. She watches her red lamp, and the moment it jumps to life, starts to play, stopping as soon as it dies away. She has no other information as to the length of time she may be called upon, and has to use her own judgment as to what to play.

The reason for her presence is to fill in the gaps which will occur in the best managed programmes, and to obviate those unpopular announcements, "will you stand by for two minutes, please." At 2LO an O.B. is almost always on one of the programmes. This is timed provisionally, but the B.B.C. often has no control over it, and if it is late, simply has to wait.

An Example

If, for instance, the O.B. consists of an excerpt from a performance in a hall in Manchester, the engineers are on the spot, of course, and are connected to 2LO with a direct line. When the time for switching over draws near, they usually enquire from the conductor of the orchestra by improvised signals. If he indicates that they are, say four minutes late, then the message is passed to the Control Room, and the waiting pianist forthwith instructed to commence.

When the engineers are ready, the signal is flashed along the line, the pianist stops, the announcer gives his foreword, and the relay comes over. Finally, when the number is over the engineers disconnect from their end, and give the last O.K. signal to London.

Here are full constructional details of a fine set that will give music from the loud-speaker at any time of the day or night. It is capable of giving the choice of a number of radio programmes and can be used for getting the best possible results from a gramophone when wireless offers nothing to the operator's taste

The GRAMO-RADIO FOUR

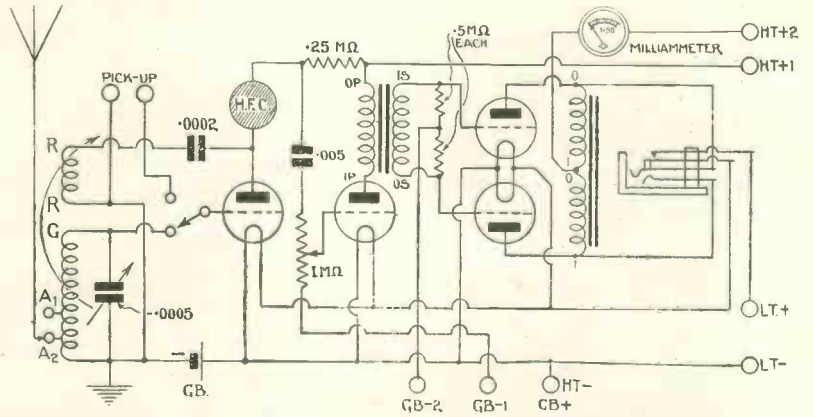
Music At Any Time With This Receiver — Designed, Built and Tested by the "W.M." Staff

BY now, almost every valve-set owner who also possesses a gramophone knows the advantages of reproducing electrically-produced records through the medium of an amplifier and loud-speaker, but for the benefit of those who have so far overlooked the possibilities they may be repeated here.

Chiefly the advantages of reproducing gramophone records electrically, by means of a high-class radio set, are improved quality (particularly in respect of the bass), elimination of needle scratch, and increased volume which is easily controllable.

These facts coupled with the possibility of having a continuous source of music at any time during the day (or night, even, if desired) make "gramo-radio" a welcome development.

None of these advantages can be obtained, however, unless a really high-quality receiver is used; this must be capable of giving really good volume to work a cone or moving-coil loud-speaker.



Here is the circuit of the Gramo-Radio Four. Note the position of the electrical pick-up

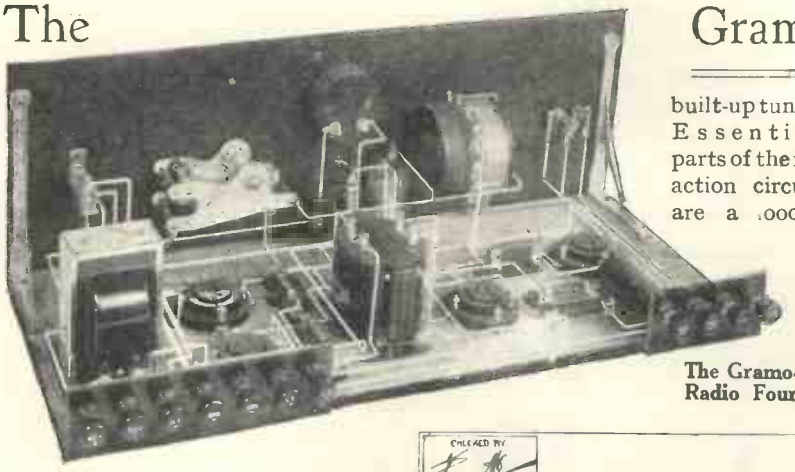
Advantage of Transformer

In the ordinary way it is best to use a resistance-capacity coupled amplifier in order to ensure proper reproduction of the bass notes, but a well-designed amplifier incorporating a stage of transformer coupling is an advantage.

This Gramo-Radio Four comprises four valves, arranged in the following way: (1) Anode-bend detector with reaction, (2) resistance-coupled low-frequency amplifier, (3) and (4) push-pull transformer-coupled low-frequency amplifiers.

It will be apparent even to the

The Gramo-Radio Four (Continued)



The Gramo-Radio Four

novice that this arrangement will give the greatest possible undistorted output for local working, either from a broadcasting station or a gramophone pick-up.

For power combined with purity it is pretty generally agreed that one stage of resistance-capacity coupling and a stage of transformer coupling working together give the best results. Adequate output with the minimum of high-tension voltage is ensured by using a push-pull stage.

The Gramo-Radio Four is so arranged that the pick-up is connected permanently to the set, being brought into use when required by means of a simple push-pull switch which, when in the other position, allows the receiver to be used for ordinary broadcast reception. Of course, as no high-frequency amplification is provided, no great range is claimed for the receiver, but, nevertheless, under ordinary conditions it should be possible to receive a number of alternative programmes.

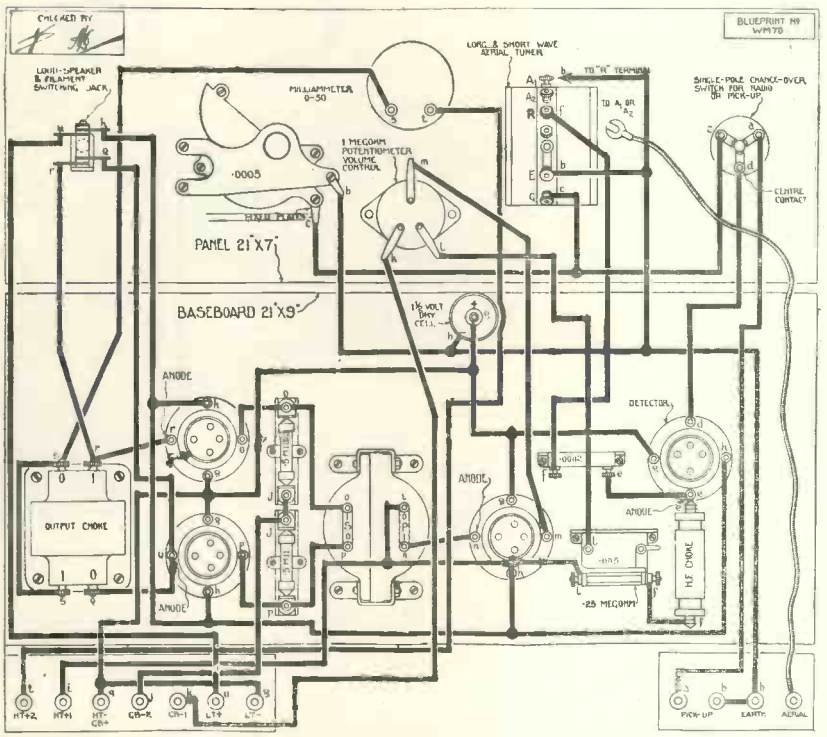
Use of Special Tuner

Details of the design will best be appreciated after a glance at the circuit diagram reproduced on page 337. A built-up tuner is employed (this covers both wavelength bands) and this is provided with two tapping terminals to get the desired degree of selectivity. This is tuned by a .0005-microfarad variable condenser and the voltage fluctuations produced across the circuit are applied to the grid and filament of an anode-bend detector to give the maximum purity and, incidentally, good selectivity. A constant negative bias of 1½ volts is applied to the grid.

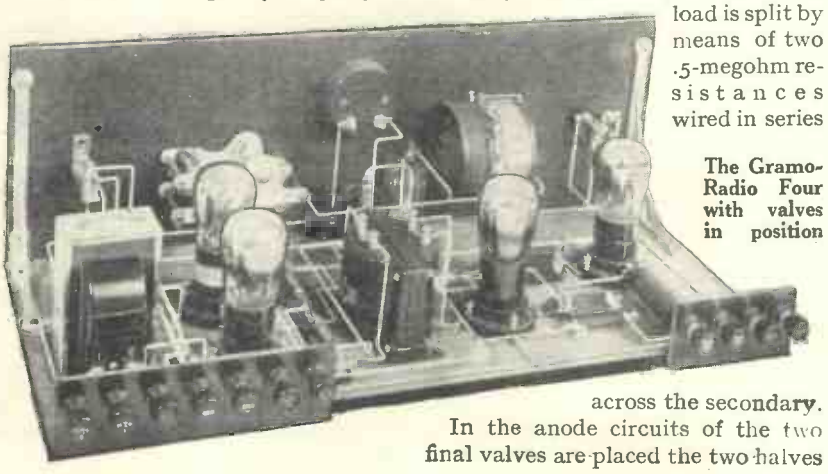
Reaction is controlled by moving the reaction coil, which is part of the built-up tuner. Essential parts of the reaction circuit are a .0002-microfarad condenser and a good quality high-frequency choke.

The resistance-capacity coupling to the next valve consists of a .25-megohm resistance and a .005-microfarad condenser. The associated grid-leak is actually a potentiometer with a resistance of approximately one megohm; this is wired up as a variable resistance and gives an adequate control of the volume.

"Push-pulling" two stages of amplification means dividing the load equally between two valves in such a way that one valve amplifies one half-cycle and the other valve amplifies the other half-cycle. In this case an ordinary transformer is used and the load is split by means of two .5-megohm resistances wired in series across the secondary.



This layout and wiring diagram can be obtained as a full-size blueprint for half-price, that is 9d. post free, if the coupon on page iii of the cover is used before May 31



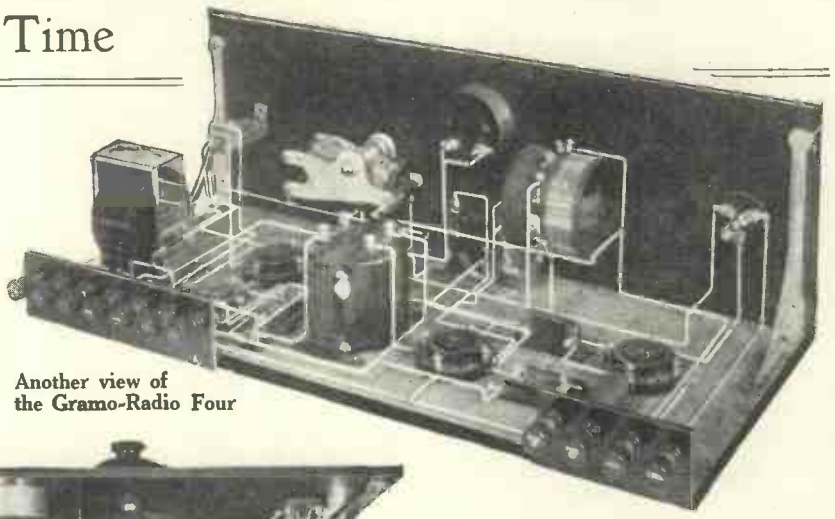
The Gramo-Radio Four with valves in position

In the anode circuits of the two final valves are placed the two halves

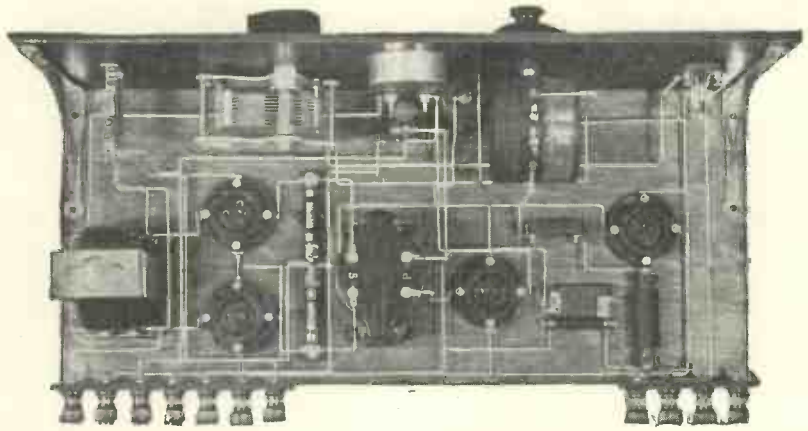
Music At Any Time

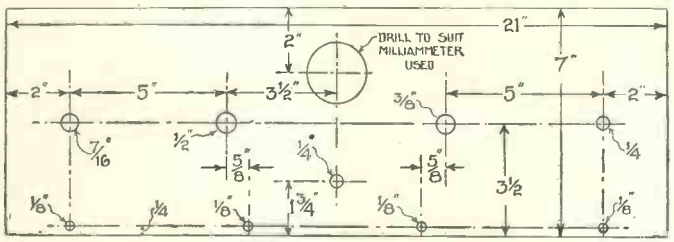
of a double-wound choke, the centre point of which is connected to high-tension positive through a milliammeter. This enables the grid bias to be so adjusted that the high-tension current is kept as low as possible and also gives an infallible check on the quality of reproduction.

A jack is provided for the loud-speaker and this is also arranged so that low-tension supply is cut off when the plug is withdrawn.



Another view of the Gramo-Radio Four





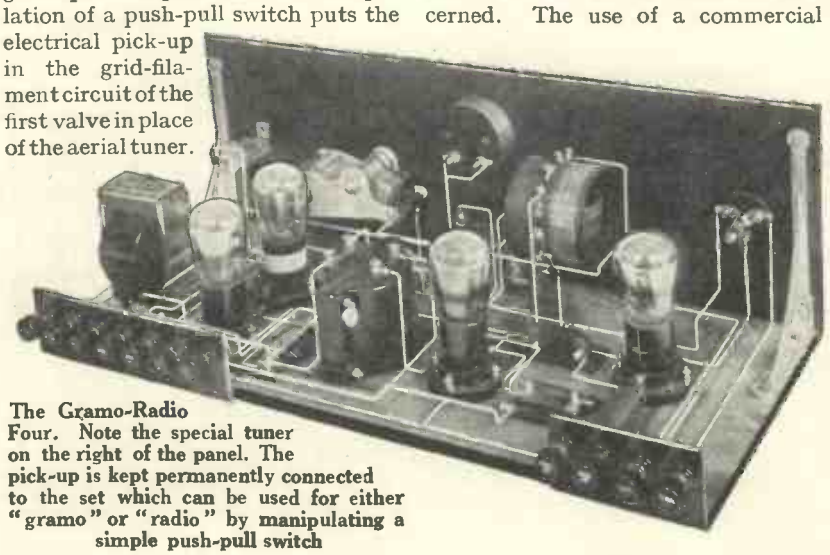
(Above).—Plan view of the Gramo-Radio Four

(Right).—Panel layout, not required if a blueprint is used

When it is desired to convert the Gramo-Radio Four from radio to a gramophone reproducer, the manipulation of a push-pull switch puts the electrical pick-up in the grid-filament circuit of the first valve in place of the aerial tuner.

Attention may be drawn to the particular simplicity of the Gramo-Radio Four as far as control is concerned. The use of a commercial built-up tuner means that both upper and lower wavelength bands can be covered without the need of changing any coils and, moreover, the cost is quite low.

There is only one tuning condenser to manipulate and the only other "essential" control is the reaction knob. The volume control is needed only for gramophone reproduction and does not need constant adjustment.



The Gramo-Radio Four. Note the special tuner on the right of the panel. The pick-up is kept permanently connected to the set which can be used for either "gramo" or "radio" by manipulating a simple push-pull switch

Simple Panel Controls

Looking at the front of the panel the controls are: (1) Push-pull switch for "radio" (in) or "gramophone" (out); (2) double tuner dial, centre knob for changing wavelength range and outer knob for controlling reaction; (3) milliammeter; (4) volume control knob (3 and 4 are one above the other in the centre of the panel); (5). variable tuning condenser; and (6) jack for loud-speaker plug which also acts as on-off filament switch.

Little difficulty should be experienced in collecting the components together if full use is made of the list reproduced on page 340. The names mentioned first in the brackets are those of the manufacturers whose components were used in the original WIRELESS MAGAZINE receiver; the others are recommended alternatives.

Use of Full-size Blueprint

Actual construction of the set will be greatly facilitated by the use of a full-size blueprint; this can be obtained for half-price, that is 9d. post free, up to the end of May, if the coupon on page iii of the cover is used. Ask for blueprint No. W.M.70 and address your enquiry to Blueprint Dept.,

The Gramo-Radio Four (*Continued*)

COMPONENTS REQUIRED

1—Ebonite panel, 21 in. by 7 in. (Becol, Redfern's or Raymond).
1—Long- and short-wave tuner, with reaction winding (Wearite or R.I. and Varley).
1—.0005-microfarad variable condenser (Igranic, Cyldon or G.E.C.).
1—Milliammeter, reading 0—50 (Sifam).
1—High-resistance potentiometer, approximately 1 megohm (Igranic).
1—Panel-mounting single-pole change-over switch (Deckorem, Lissen or Lotus).
1—Plug and jack (Igranic P63 or P65).
4—Anti-microphonic valve-holders (Lotus, W. and B. or Igranic).
1—.0002-microfarad fixed condenser, upright type (Graham-Farish, Dubilier or Lissen).
1—.005-microfarad fixed condenser (Graham-Farish, Dubilier or Lissen).
1—.25-megohm grid leak (Graham-Farish, Dubilier or Lissen).
1—High-frequency choke (Cosmos, Igranic or Wearite).
1—Low-frequency transformer, ratio 6 to 1 (Marconi Ideal or Igranic 7½ to 1).
2—.5-megohm grid leaks with holders (Mullard, Dubilier or Lissen).
1—Double-wound low-frequency choke (Igranic, R.I. and Varley or Ferranti).
1—1½-volt dry cell (Ever-ready type UW1).
2—Terminal strips, 7 in. by 2 in. and 4 in. by 2 in. (Becol, Redfern's or Raymond).
11—Terminals, marked: Aerial, Earth, Pick-up, Pick-up, L.T.+, L.T.—, G.B.—1, G.B.—2, H.T.+1, H.T.+2, H.T.— (Belling-Lee).
8—2-ft. lengths of insulated wire (Glazite).
1—Pair panel brackets (Camco, Magnum or Igranic).
1—Cabinet with baseboard 9 in. deep (Caxton).
1—Length of flex with spade tag.

WIRELESS MAGAZINE, 58/61, Fetter Lane, E.C.4.

Mounting Panel Components

First fix the panel components in position (the positions of the various parts are clear from the paragraph on controls on p. 339) and then fix the panel itself to the baseboard. Screw the two terminal strips to the back edge of the baseboard and mount the remainder of the components in position on the latter.

Looking from the front of the panel the baseboard components are, from left to right: Detector valve-holder, high-frequency choke, fixed reaction condenser, coupling condenser and anode resistance, first low-frequency valve-holder, low-frequency transformer, "push-pulling" resistances, two valve-holders for final amplifying stages, and the double-wound choke. The single dry cell for supplying bias to the anode-bend detector is also placed on the baseboard.

As soon as all the components have been fixed in position, wiring up can be started and for this operation the full-size blueprint will be found of great use.

It will be noticed that each terminal point on the blueprint and on the wiring diagram reproduced on p. 338, is marked with a small letter of the alphabet; these letters indicate which points should be connected together and in what sequence.

For example, all those points marked *a* are first connected together with one wire or as few wires as possible; then all those points marked *b* should be connected together, and so on through the alphabet.

When the wiring is completed a rough test of the receiver can be carried out. No question of choosing suitable coils arises owing to the use of a complete tuner, but two aerial terminals are provided and both of these should be tried.

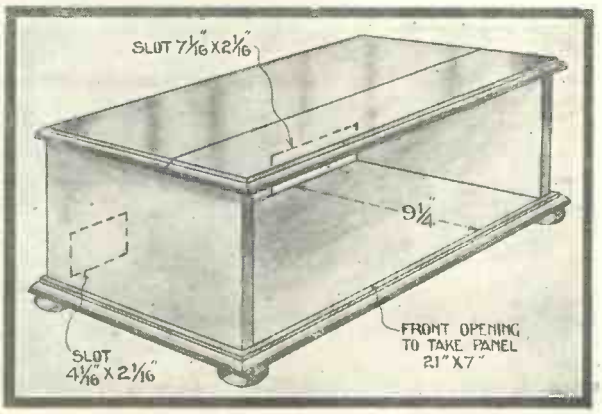
Suitable valves are indicated in the table reproduced on this page. The detector-valve should have an impedance in the neighbourhood of 80,000 ohms, the first low-frequency stage an impedance of about 15,000 ohms, and the two final valves should be of about 5,000 ohms impedance or less.

To test the receiver connect up the terminals in the following way: to H.T.+1 apply about 80 or 90 volts and to H.T.+2 about 120 volts. To

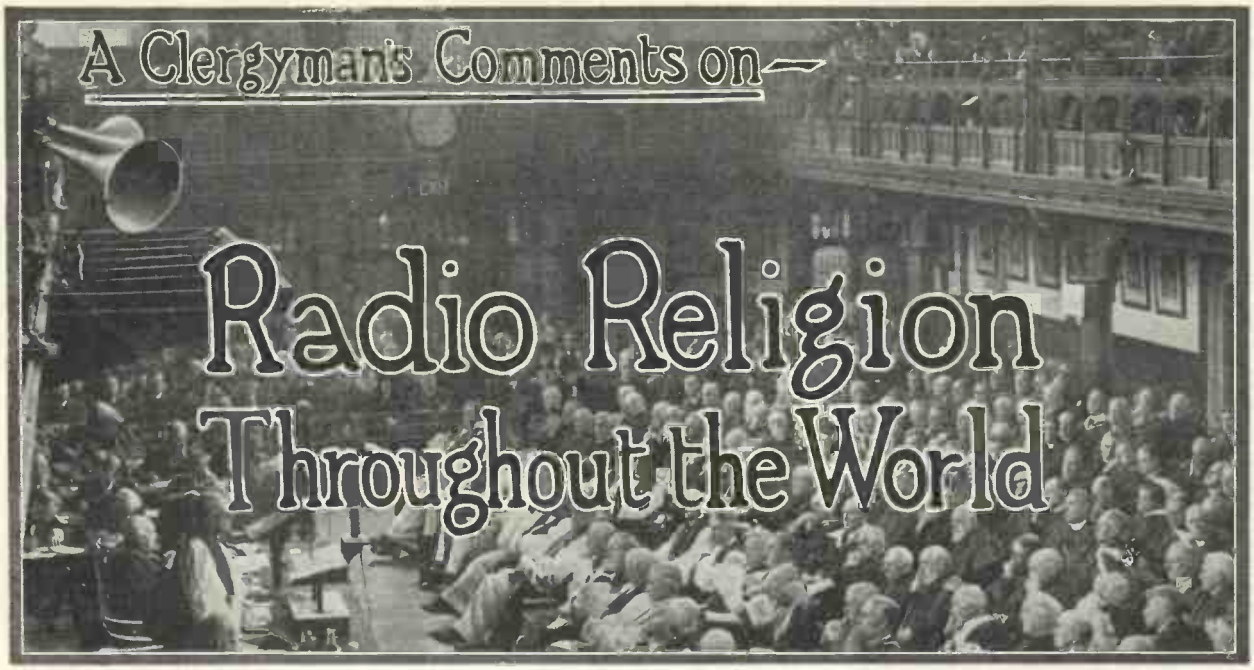
(*Continued on page* 357)

VALVES TO USE IN THE GRAMO-RADIO FOUR

Make	Detector.		1st L.F. Amplifier.		2nd and 3rd L.F. Amplifiers.	
	2-volt.	6-volt.	2-volt.	6-volt.	2-volt.	6-volt.
B.T.H. ..	B210H	—	B210L	—	B215P	B4
Cossor ..	210R.C.	610R.C.	210L.F.	610L.F.	220P	610P
Cosmos ..	SP18B	SP50B	SP18RR	SP50R	SP18RR	SP50R
Ediswan ..	—	—	PV6	ES5L.F.	PV2	PV610
Marconi ..	DEH210	DEH610	DEL210	DEL610	DEP240	DEP610
Mullard ..	PM1A	PM5B	PM2	PM6	PM252	PM256
Osram ..	DEH210	DEH610	DEL210	DEL610	DEP240	DEP610
Six-Sixty ..	SS210 R.C.	SS6075 R.C.	SS215 P	SS610 P	SS215 P	SS610 P



Details of cabinet for the Gramo-Radio Four



WITH the tendency of religion to lose its hold on the "man in the street" in most countries where the white man holds sway, it is significant that radio has not only brought religion back into favour, but has also proved to be a handmaid. Radio arrested the downward tendency in religious enthusiasm and allegiance.

Encouragement

Throughout the English-speaking countries and beyond, instead of prohibiting religious items, radio has encouraged them where they are not partisan and denominational; it has given them a hearing in the drawing-rooms and cottages of those people who were unfriendly.

The effect, however, has not been the same in every country. For instance, in the U.S.A. religion is creating a nausea. The reason for it is this: So many stations broadcast the viewpoints of one particular denomination or sect. Others are built and sustained by a sect for the propagation of its own tenets. The result is chaos in the ether and more chaos in the homes of the listeners.

Chaos in America

The editor of *Popular Radio*, one of the leading wireless periodicals in America, says: "Religion has produced chaos on the ether." And no wonder, for the Baptists, Methodists, Wesleyans, Christadelphians, and other sects too numerous to mention have one or more stations of their own where they broadcast their own doctrines only.

Much the same is the state of things in Canada. The manager of Universal Radio of Canada writes: "The International Bible Students' Association have the exclusive use of our four stations in Canada for religious propaganda."

On the Continent of Europe matters are the other extreme. The Russian stations never allow any religious talks; indeed, whenever religion is mentioned it is mentioned in derision as something not worth while for the listener.

The stations of France, Germany, Holland, Belgium, and Sweden broadcast an occasional service. We hear the beautiful church and cathedral bells oftentimes. Occasionally we hear a service; sometimes a relay of church music from a church. But there is no system or order in any European country.

This is the Rev. Canon "Pat" McCormick, who succeeded the Rev. H. R. L. Sheppard as vicar of St. Martin-in-the-Fields, and who, by means of radio, probably has a larger congregation than any other clergyman in the world

Sweden Provides a Contrast

Sweden is the country that gives most time to the broadcasting of religious matters among these nations. Less than half the European stations broadcast any religious matter at all.

The B.B.C., like the nation it represents, has found a *via media* between the extremes of the Continent and America. Much religious matter is broadcast, but there is no chaos. No sectarian matter is allowed, and there is satisfaction among the sects. We have a noon organ recital from a church at least once a week, an evensong also likewise. On Sunday we have Old Testament stories and a children's service, and then that popular service at about eight o'clock in the evening.

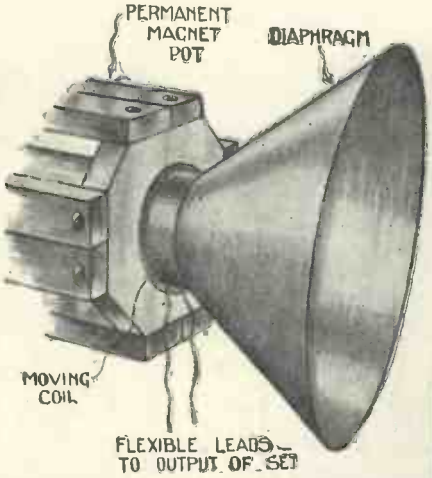
Cardiff's Silent Fellowship

But perhaps the religious items that have grasped the imagination and heart of our nation are the epilogue from London and the Silent Fellowship from Cardiff. Through these services the B.B.C. has made religion popular in many homes. The radio of the world can look up to us here for an ideal of tact and common sense.

E. E. R.

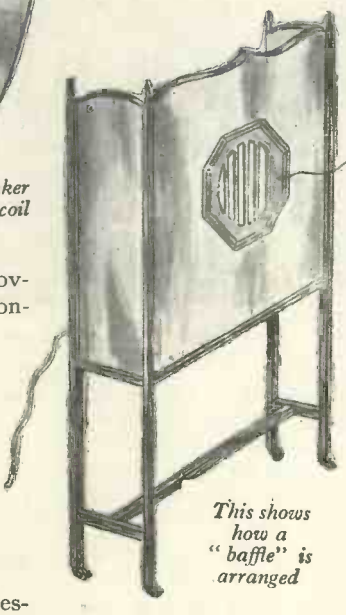
Many Readers Must Be Asking Themselves:

Is A Moving-coil Loud-speaker Worth While?



Arrangement of moving-coil loud-speaker with permanent magnets. The moving coil is being inserted into the "pot"

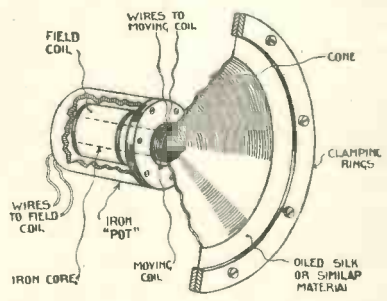
PARTICULARS of the first moving-coil loud-speaker to be constructionally described in the pages of the WIRELESS MAGAZINE were given in the March issue, and we know from the demand for blueprints that the instrument met the needs of a very large number of readers indeed.



This shows how a "baffle" is arranged

Cleaning Up Obscure Points

A considerable amount of correspondence has ensued with WIRELESS MAGAZINE readers all over the country, from which it is apparent that quite a number of amateurs are in a state of indecision about moving-coil loud-speakers. They are not quite sure whether they are worth while or not, and it is the object of this article to clear up some of the obscure points.



In this diagram all the parts are shown. The magnetic field is produced by current from the mains or an accumulator being applied to the field coil

In such a case it is best to start at the beginning and explain briefly just what is the principle of a moving-coil loud-speaker. The principle will be at once apparent to most listeners when it is explained that the cone is simply an enlarged diaphragm, of which the "magnetic" part is a small coil of very fine wire.

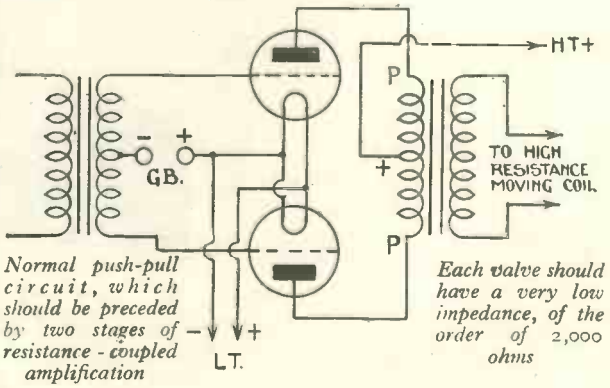
From the diagrams reproduced on this page it will be apparent that the small coil is fixed to the apex of the cone. This takes the place of the ordinary loud-speaker winding in the circuit, being connected directly to the output terminals of whatever receiver is used. Around this moving coil is placed a very powerful magnetic field, produced either by large permanent magnets or, more usually, by a large magnetic winding placed in a soft-iron "pot" and excited with a current taken either from the electric-light mains or an accumulator. Fluctuating currents passing through the small coil connected to the receiver cause this to move in the magnetic field and consequently the cone produces sound waves which are audible as ordinary signals.

Two Special Points to Note

Two points should be specially noted: The moving coil must carry a large number of turns in order to produce the required magnetic effect to actuate the cone diaphragm, and the magnetic field in which it moves *must* also be very powerful. For this reason it is preferable to use a "pot" with a field winding, which can be excited with current from the mains or an accumulator rather than permanent magnets. The latter type of loud-speaker, however, is very often the only one which the amateur can use, for the consumption of low tension for a field winding (something in the neighbourhood of 1 ampere at 6 volts) is more than many listeners have at their disposal.

Arrangement of the Moving Coil

The moving coil itself can consist of a large winding of fine wire having a high resistance, which can be placed directly in the choke output circuit of the receiver, or, alternatively, it may consist of a fewer number of turns of thicker gauge wire coupled to the output circuit of the valve through a step-down transformer. It is essential that only a minute air gap should be left between the moving coil and the surrounding magnet. In fact, the smaller this gap the more efficient



Normal push-pull circuit, which should be preceded by two stages of resistance-coupled amplification

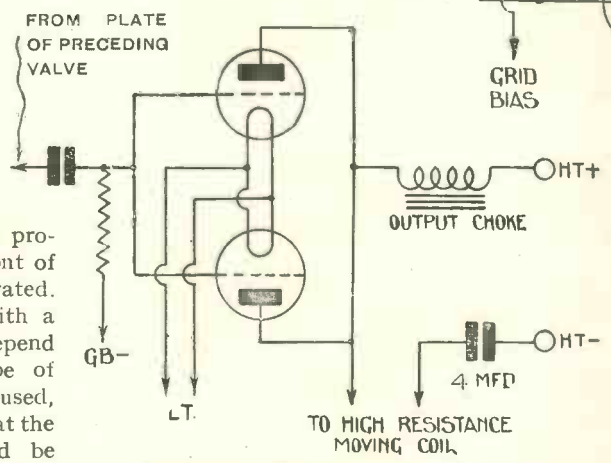
Each valve should have a very low impedance, of the order of 2,000 ohms

will be the loud-speaker, although care must be taken that the parts do not actually rub, of course.

Why A Baffle Is Essential

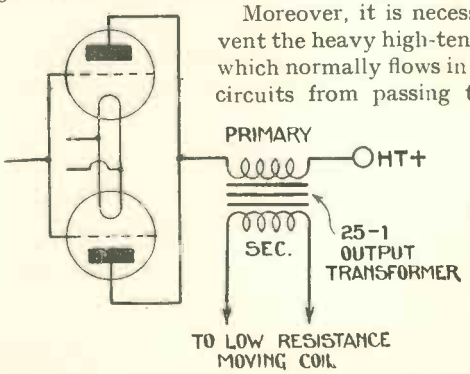
In order that the quality should be good, it is necessary to so arrange the cone that air waves produced at the front of it cannot immediately turn back over the edge and collide with those air waves actually produced at the back of the diaphragm; to prevent this what is called a "baffle" is employed, and in practice the cone is inserted in a hole in a board, which may measure about a yard square. The edge of the cone is fastened to the board by means of oiled silk, thin chamois leather, thin rubber, or similar material, so that there is no air gap, and air waves produced at the back and front of the cone are kept well separated.

The results obtained with a moving-coil loud-speaker depend very largely on the type of receiver with which it is used, and it is almost essential that the final output stage should be capable of passing a current in the neighbourhood of 20 milliamperes. Either a really low-impedance power valve of the order of 1,500 ohms must be used, or two super-power valves with impedances of 3,000 ohms or so must be wired in parallel.



Another and simpler output circuit, which should be preceded by two stages of ordinary amplification

Moreover, it is necessary to prevent the heavy high-tension current which normally flows in these anode circuits from passing through the moving coil of the loud-speaker, and for this reason *an output choke must be incorporated* in the receiver. In these pages four suitable output circuits, each of which makes use of two parallel or "push-pulled" valves, are shown. One of these circuits is suitable only for a low-resistance moving-coil loud-speaker, while the other three can be used for either high- or low-resistance movements.

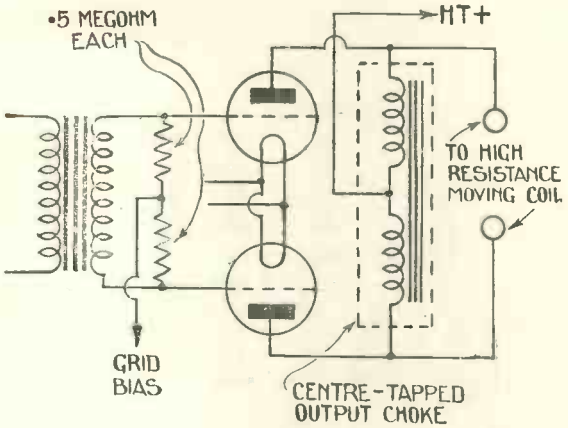


Simple parallel-valve circuit for use with a low-resistance moving-coil loud-speaker

Adapting A High-resistance Output Circuit

To adapt a high-resistance output circuit to a low-resistance output circuit it is only necessary to connect a step-down output transformer with a ratio of approximately 25 to 1 in the position indicated for the high-resistance coil.

In order to obtain absolute purity of reproduction, it is desirable that the preceding low-frequency stages of the receiver should be resistance-capacity coupled, and



A useful system of "push-pulling" two valves without the need for special transformer

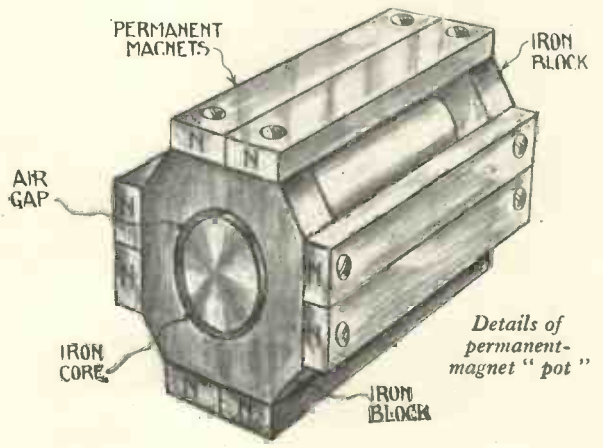
at least two such stages should be incorporated if adequate volume is to be obtained. Probably the ideal receiver for use with a moving-coil loud-speaker is one containing two H.F. stages (or one stage employing a screened-grid valve), an anode-bend detector, two resistance-coupled low-frequency stages, and a final parallel-valve output stage.

From these remarks it will be apparent that it is not cheap to build or maintain a moving-coil loud-speaker outfit, but to those who are prepared to pay the cost, it will undoubtedly give a quality of reproduction that is unequalled by any other loud-speaker available to the amateur.

Maintenance Expense of Suitable Set

Quite frankly it can be said that it is not worth while using a moving-coil loud-speaker with an ordinary two- or three-valver. For really good results the operator must be prepared to supply a heavy anode current for the final stages of the receiver, and this is certainly expensive unless the necessary current can be obtained from the mains or a high-tension accumulator. If one's pocket can stand the cost a moving-coil loud-speaker *is* worth while.

BM/PRESS



Details of permanent-magnet "pot"

Read This Story Before Starting on Your Spring Overhaul!

THE MAST THAT FAILED

WITH the first tender buds of spring, Charles bursts, not into poetry, but into a frenzied overhaul of all his receiving apparatus. He goes over everything, from the insulators at the far end of his aerial to his new patent phone cosy to keep the earcaps warm and comfortable during the cold weather.

Usually he invites me over to his house on these occasions, nominally to look on, actually to do most of the work. This year, as soon as I had been shown up to his wireless den, I knew that there was something new in the air. Those romantically inclined might have called it a touch of spring. For my part, I was inclined to attribute it to the gases from an overcharged accumulator in the corner.

The room was full of the complicated tangle of gadgets and wires so dear to the heart of the real, hundred per cent. Post Office licensed experimenter—(sign along the dotted line, please, enclosing ten bob, your photograph, birth certificate and the testimonial of a solicitor, minister, or Justice of the Peace, etc. etc.).

The master of the ceremonies was temporarily absent, and his small daughter's kitten was busily engaged in exploring the interior of his latest "super" set. As it happened, Charles had forgotten to detach the battery leads from the set, and presently an ear-splitting screech informed me that the wandering feline had made the acquaintance of ninety volts high t nsion. I released the startled animal and lifted up my voice in a stentorian bellow for Charles' immediate return.

A minute or two later he came up the stairs two at a time and fell over the cat on the landing. I gathered from his language that the cat had retaliated, and I hastened to soothe him down by complimenting him upon the business-like appearance of his den. Somewhat pacified he led the way into the garden where the storm centre of the annual overhaul was now raging.

The potato patch looked like "No Man's Land" after a particularly heavy bombardment. A deep pit half full of muddy water gaped at my feet; by the side of this lay a dozen earth tubes, shining bright and neatly wired together with copper tape. It seemed that Charles was installing a new earth system on a really ambitious scale.

"Don't go down the mine, Daddy," I murmured gently, as Charles slithered in the quagmire at the bottom of the pit. I handed him down the munitions of war, including a large bag of coke which he stacked professionally around the copper tubes.

Leaving the pit for the gardener to fill in the next morning, he clambered up to the surface with some difficulty—for Charles has a big future in front of him, or, as they say in schools and places where they teach, a most generous equator. Perspiring freely he stood beside me for a moment gloating over his handiwork. Then, still yearning for a still more perfect earth, he led me across what was left of the cabbages to his new aerial mast.

The pole had only just arrived, and with it one of those patent gadgets for raising and lowering it so that the proud owner may be able to have the thing down to tinker with the pulley whenever he feels inclined. I now began to see the reason for my invitation; I was to help him to hoist the mast into position, and as I noticed the length and girth thereof, I experienced a good deal of that sinking feeling. But it seemed that Charles was not yet ready for the *pièce de résistance*, as it were.

He threw off his coat and began to dig another hole. He had, he told me, designed an aerial-earth system which would have Daventry licked to a frazzle: an earth plate was to be buried directly beneath the end of the aerial.

After a while he informed me that the time for the next shift had arrived, and handed the spade to me. For ten minutes I dug furiously and well, but after I had gone down to a goodly depth I became aware of a strange, unsavoury odour. I looked round, expecting to see a heap of rotten cabbages in the offing, but I could find nothing more suspicious than a derelict wheelbarrow. I returned to my hole, and put in another ten minutes at the confounded business. The smell got worse. I blew my nose

and tried to think of lavender and wild thyme.

But my most persevering efforts at auto-suggestion collapsed miserably before the appalling reek that brooded over the neighbourhood. Then I noticed something peculiar at the bottom of the hole. Holding my nose tightly, I shovelled it up and flung it as far away as I could; as a matter of fact it went into the next garden.

"Charles!" I said sternly and reproachfully to the culprit as he wrestled with the aerial winch; "it is nothing to me that you should run a private cemetery for deceased pets on your leasehold domain. But, as man to man, I think you might at least have warned me before."

Charles mumbled that some people were extraordinarily fussy about a slight whiff or two, and continued to unravel a coil of steel cable. Feeling that my time had come I prepared for the worst, and breathed a silent prayer that the end might come mercifully and swiftly.

Together we toiled and sweated to hoist the mast into position. We raised it inch by inch until at last it stood almost upright, towering proudly above the lesser and meaner aerial poles of the neighbours. Charles stood back to get a better view of it. And just then the fastening came undone.

◆ ◆ ◆

The doctor said that it was Charles's hat which saved his life. As it was he had got off with a mild case of concussion. Charles's neighbour said that these little things were sent to try us, and that he didn't mind waiting for a new greenhouse until the convalescent was up and about again. Charles himself said nothing at all for a week, chiefly because of the bandage which bound up his jaw.

But I understand that he thinks seriously of giving up wireless for poultry farming.

G. J. M.

WHAT STATION WAS THAT?

The Editor of the "Wireless Magazine" has made arrangements to assist readers who are in difficulty over the identification of broadcasting stations they receive.

Each query should give as many particulars as possible (such as time, date, wavelength, language, and distinctive call or signal) and should be accompanied by the coupon on page iii of the cover and a fee of one shilling (postal order or stamps).

Address each query to "Station Identification," "Wireless Magazine," 58-61 Fetter Lane, London, E.C.4.

Can You Get Sharp Tuning?

DESPITE the increasing popularity of Reinartz, Hartley, and similar circuits, it is still most exceptionally difficult for simple two- and three-valvers (without H.F. stages) to give good selectivity.

Accentuated Trouble

In some cases this trouble is accentuated by the use of too large an aerial, for with a great length of wire the resulting capacity, damping and great "impact" voltage from all stations within range prevents anything like sharp tuning being obtained. Signal strength is seldom seriously reduced if the aerial length or height is cut down.

With powerful receivers small aerials are a *sine qua non* if sharp tuning is required.

Centre-tapped coils, as used in some Hartley modifications, and the provision of a small aperiodic aerial coupler, as in Reinartz circuits, do much to prevent and minimise the damping effect of large aerials. The trouble cannot entirely be cured by "stunt" coils, however. Two- and three-valvers must generally be as simple and straight-forward as possible, and anything in the nature of complicated tuning coils or controls must be barred.

Wavetraps, although useful, are not the limit of perfection. They are a cure for non-selectivity, and not a prevention. Moreover, even the simplest wavetrap means an added coil and condenser knob with which to "wangle" when tuning.

Ideal selectivity can be obtained by adding one or more H.F. valves, but not everyone is willing to go to this expense.

Getting to the Source

Why not cure the trouble at its source? The real cause of non-selectivity is that there is a leak for high-frequency currents across the aerial and earth input. This leak reduces the efficiency of the tuning arrangements and prevents sharp tuning.

The first move is to find out where this leak is occuring in your set. Panel insulation leakages or the use of condensers or coils which are not of the low-loss type may be the primary cause; but even if all the components can be passed as satisfactory there is the possibility that the valve itself is causing the leak! If grid-condenser-and-leak rectification is used, then the matter is a certainty.

Glance at the characteristic curve of the detector valve. Even when the grid voltage is zero there will, in most cases, be a small amount of grid current flowing. When the grid is 1 or 2 volts positive (as it must be if grid-leak rectification works, for the leak itself maintains this potential difference) there is a considerable amount of grid current flowing. The fact that grid current flows means that the space between the grid and filament of the detector valve is not an insulator, but is a leak of not too high resistance.

This leaky space is connected directly across the tuning coil, and hence the lack of selectivity.

A Simple Cure

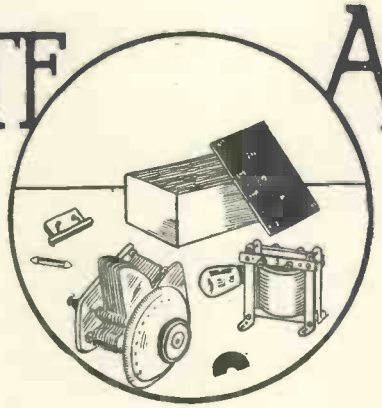
The cure? Simple! Substitute anode-bend rectification, using a potentiometer, for the grid-leak system. With anode-bend the grid is several volts negative, and little or no grid current can flow; so there will be no loss of selectivity.

Do not think this is a wholesale condemnation of grid-leak rectification, which is indispensable on some occasions! But when you have tried all the tips you know to obtain selectivity, and have failed, give anode-bend rectification a chance.

QUEUE.

Every Amateur Who Has Been in the Radio Game for More Than a Year Should Read This Article

DON'T WASTE YOUR OBSOLETE APPARATUS!



MANY wireless enthusiasts have by now built their spring receivers, incorporating all the latest designs of components that they can afford.

When the set is completed, the constructor is often at a loss as to what to do with the old-type apparatus that he has discarded in favour of new gear.

Here, then, are a few suggestions from personal experience.

A Home Museum

Firstly, let me mention an idea that, while not exactly a practical use for old components, may appeal to many experimenters. In a large cupboard with a glass door I have neatly arranged components that are now old-fashioned. Some are extinct, and may be quite interesting and valuable in twenty years time.

I have a shelf devoted to valves, mostly with burnt-out filaments. They range from one made by the G.E.C. to specifications supplied by the National Physical Laboratory and having a disc anode of silver to modern power valves. Wherever possible, I have obtained two identical specimens, and from one I remove the glass envelope to expose the construction and arrangement of the electrodes.

Other "Exhibits"

Among the other "exhibits" are loose-coupled crystal sets, tapped solenoid loading coils wound to Bordeaux's wavelength, semi-circular plate variable condensers, an old one-inch spark transmitter, a home-made filing coherer with tapper, and a dozen small glass jars with different kinds of crystals with which I have experimented.

All the exhibits have near them a piece of card with notes as to the historical and practical interest typed on it.

Small objects are numbered, and a card is made out bearing the numbers and details of as many things as possible.

Visitors to my den have always been most interested in the little museum, and it is always a pleasure to me to take out some old veteran and discuss his life with them.

More Practical Outlet

To those who prefer a more practical outlet for old apparatus, I suggest that there are many young enthusiasts who are yearning to put their itching fingers on their own control knobs. What care they if the condenser is not "square-law," or the rheostat not so velvety as now demanded? Does it matter to them if the valve holder isn't antimicrophonic as long as they can pull in a few signals? And I've heard some results from these youngsters' "junk" sets that would be a credit to many a so-called low-loss modern receiver.

Many lads cannot afford valve receivers, or have to wait a long time while they save up. They know quite a deal from wireless periodicals about the working of a set. Why not help some young friend to pull in his first signals? Will you ever forget the time that you first heard signals from the ether? Not likely! Well, then, pass the pleasure on and add another recruit to the ranks of the radio fans.

If you cannot dispose of your old components, they are handy for rough experimenting when you have no wish to break down a set to try out a fresh circuit.

Controlling Feed-back

The old-type semi-circular plate variable condenser, providing it is electrically perfect and not liable to short, can be used to control the amount of feed-back when capacity reaction is used. There is no real need for square-law condensers in this position, as we are controlling feed-back which is dependent upon the capacity existing between the anode and grid circuits.

Many aerial-tuning condensers of a season or two ago were of a capacity of .001-microfarad, which is rather too high for fine tuning, even with verniers, over the present congested broadcast wavelength band.

They can, however, be used in conjunction with a .001-microfarad fixed condenser so that the tuning value is from minimum to .0005 microfarad. The two condensers are joined in series and placed in parallel with the inductance to be tuned. This arrangement may be used with any type and capacity of variable condenser.

Series Condensers

For example, a .0005-microfarad fixed condenser in series with a .0005-microfarad variable condenser will have a maximum of .00025-microfarad and a very low minimum. A .00025-microfarad fixed condenser and a .0005-microfarad variable condenser will have a maximum capacity of .00017-microfarad, which is suitable for tuning very short-wave receivers.

With some variable condensers of simple construction it is an easy matter to take off the bottom end plate and remove half of the fixed plates, thereby reducing the capacity of the condenser to approximately a half of its former value.

Removing Vanes

The moving plates that do not mesh with the remaining fixed plates can be left on the spindle as they will have no effect upon the working or efficiency of the condenser. In fact, it is not advisable to remove them as it may upset the correct re-setting of the spindle when the condenser is reassembled. Washers must be added to the lower end of the supports of the fixed plates to take up the space left by the removed vanes.

Two- or three-way coil holders may be made to serve a turn behind the panel by cutting off the handles. Many circuits require coils to be coupled, the amount of coupling, once determined, remaining fixed, being suitable for the range of the receiver.

Panel-mounting Rheostats

Panel mounting rheostats may be fixed to the baseboard by making up a small platform. The two sides can be of ½ in. wood, 1 in. high and as long as the diameter of the rheostat. The top is of three-ply or similar thin wood. See that the terminals, or soldering tags, are accessible, by bringing them right up to, or beyond, the edge of the three-ply platform. The device may be screwed to the baseboard by means of angle-brackets.

Ordinary old-type valve holders are quite all right for H.F. transformers of the old barrel type and for H.F. valves. Modern valves are not nearly so microphonic as they used to be and plain valve holders are satisfactory for experimental purposes.

Bright-emitter valves, or old type dull-emitters that have been replaced by more efficient and economical types, can still be of use in saving their modern comrade from premature demise when a new set is being tested out for the first time.

A Good Practice

It is the practice, and a very good one too, of most constructors, when testing a set for correctness of wiring, to plug in the valves and connect up the accumulator to the H.T. terminals. The valves, of course, should not light. If they do, something is dangerously wrong, and the test has saved the valves.

But modern valves take such a small current, and are so silvered internally by the "getter," that no visible sign of whether the filament is alight or not is perceivable.

The filaments of the old valves, however, are easily visible and are perfectly satisfactory for the test. Even old four- and six-volt bright-emitters will serve in a set working off a two-volt accumulator as their filaments will glow sufficiently to indicate the correctness, or otherwise, of the circuit.

It can be seen from the foregoing that even the oldest of components may be put to some use, and if from the suggestions mentioned, some old veteran is brought from out the junk box and given a place of honour, or put to further work, then this article will have achieved its purpose.

E. J. G. L.

Why Not Build Your Own Loud-speaker?

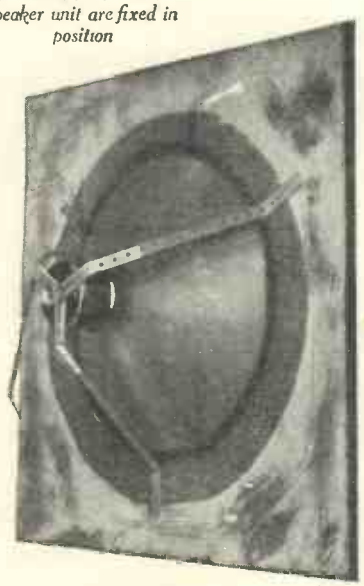
NO amateur, however inexperienced, will find the construction of a simple cone loud-speaker beyond his capabilities, and any doubt that the reader may have on this score will be removed by a glance at the photographs reproduced here.

Many of the components required will be found in the amateur's stock box. Here is a list of them :

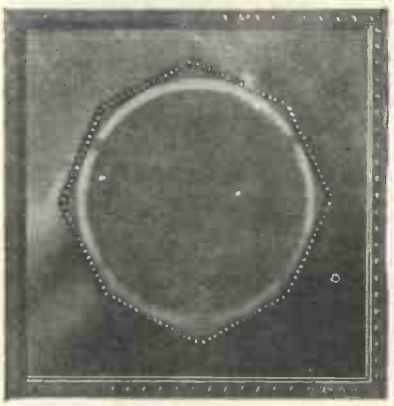
Loud-speaker unit (Goodman or Lissen).
Special paper for 12-in. cone (Goodman or Six-Sixty).
Oiled silk (or other suitable material) of same size for mounting cone.
Three-ply wood to form baffle of suitable size (Hobbies, Camco or Artcraft).
3 strips of Meccano or 3 brass strips.
Small nuts, bolts and screws.

Full constructional details for making such a loud-speaker were given on page 21 of the February issue of the WIRELESS MAGAZINE and a full-size blueprint of a similar cone loud-speaker to that described here, is available for 1s., post free (No. W.M. 55).

This photograph shows how the cone and loud-speaker unit are fixed in position



First, stick the overlapping edges of the cone and when dry put it, point upwards, on a square of oiled



A bright light has been placed behind the loud-speaker so that the extent of the cone can be seen. The front is covered with coloured silk

silk, so that at least an inch is left all round. Cut out the centre part and trim off the square corners round the outer edge of the cone.

Cutting Hole in Baffle

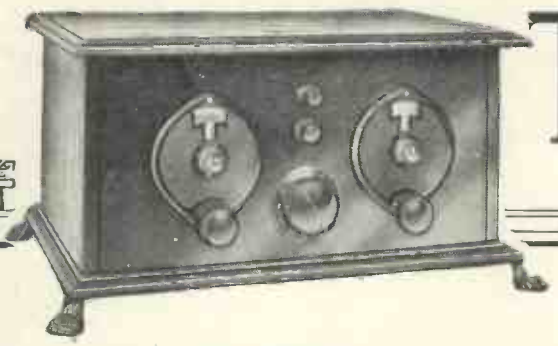
Now cut a hole in the three-ply wood a little larger than the cone and stick the oiled silk to the wood. Next screw the loud-speaker to the three metal strips and bend these until the unit is held directly in line with the apex of the cone. Attach the reed to the cone by means of the extension rod and washers provided.

The appearance of the loud-speaker can be greatly enhanced by placing a piece of coloured silk in front of the cone and fixing it in position with some fancy wooden beading.

It should be pointed out that whilst it is possible to use ordinary stiff paper for forming the cone it is very much better to use special cone paper as specified above.

Especially suitable for long-range work with headphones on an indoor aerial is the receiver described in this article. It is also useful for placing in front of an existing low-frequency amplifier, the resulting outfit being an efficient loud-speaker receiver. The construction is quite straightforward, as is the circuit

The FLAT-DWELLER'S TWO



Comprises Neutralised H.F. Stage and Detector

Designed, Built and Tested by the "W.M." Staff

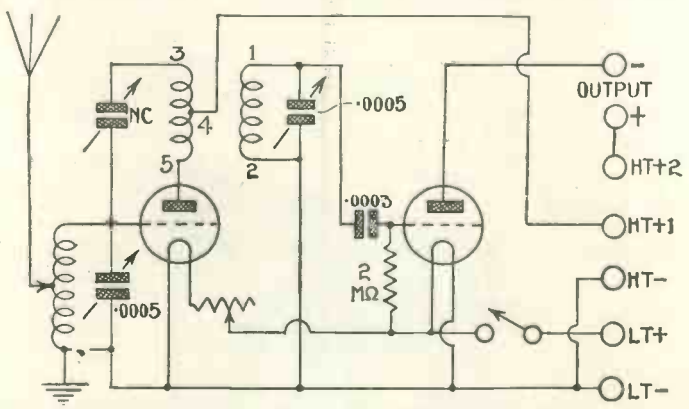
EVEN if we have not yet quite reached the age of flat-dwellers, we are well on the way towards it, at any rate in our large towns.

Specially Suitable for Indoor Aerials

Indeed, so great is the number of persons who are unable to work with outdoor aerials, that the WIRELESS MAGAZINE Technical Staff has produced a simple set adapted especially to their needs.

Flat-dwelling, besides imposing, in most cases, a restriction on the use of an outdoor aerial, also entails some obligation to neighbours in the matter of loud-speaker work, and many listeners have perforce to make use of headphones.

The set to be described in these pages is based on a circuit comprising a high-frequency amplifier and a detector, the former being neutralised on the split-primary principle.



Here is the circuit of the Flat-dweller's Two, comprising a stage of neutralised high-frequency amplification and a detector

This combination makes the set especially suitable for long-range headphone work with a comparatively small aerial—such, in fact, as can usually be arranged inside a building. Normally it will be of little value for loud-speaker reproduction, although it may operate a small loud-speaker when used close to a broadcasting station.

Another use for this set is in conjunction with a low-frequency amplifier such as many listeners are using with their crystal sets. If the crystal set is "scrapped" and this two-valver put in place in front of the existing amplifier, a powerful and efficient loud-speaker outfit will be the result.

For the sake of selectivity a centre-tapped aerial coil is used (see circuit diagram on this page), and this is tuned by a .0005-microfarad variable condenser, which, for fineness of control, is provided with a vernier dial. Following this is the high-frequency amplifier, which, as already mentioned, is coupled to the detector valve by a split-primary transformer.

It will be seen that the centre tapping on the primary is connected to positive high-tension, while the top end is connected back to the grid through the usual small neutralising condenser, to balance out the valve capacity and prevent feed-back.

The secondary of the high-frequency transformer, which is, of course, of the six-pin type, is tuned by another .0005-microfarad variable condenser, which is also provided with a vernier control. Rectification is carried out on the leaky-grid principle, with a .0003-microfarad fixed condenser and a 2-megohm grid leak.

Fine Control for Picking Up Distant Stations

Fine control of the receiver for picking up distant transmissions is obtained by providing a rheostat for

regulating the temperature of the high-frequency valve filament, while both valves can be switched on and off by means of a push-pull switch.

A glance at the photographs on these pages will show the neat appearance of the completed receiver. Of the two large vernier dials, that on the left tunes the aerial circuit, while that on the right tunes the high-frequency transformer.

It will be seen that there are two knobs and a smaller dial arranged in line down the middle of the panel. The first knob is the push-pull switch; when the knob is in, the receiver is off, and when the knob is out the receiver is switched on; the second knob is that of the behind-panel mounted neutralising condenser.

The completed Flat-dweller's Two in use with a B.T.H. loud-speaker for reception of the local station

Special Enclosed Rheostat

The small dial is the filament rheostat for controlling the high-frequency valve. Actually the resistance winding is arranged inside the dial itself, so there is nothing to be seen behind the panel except a short spindle with a lock-nut.

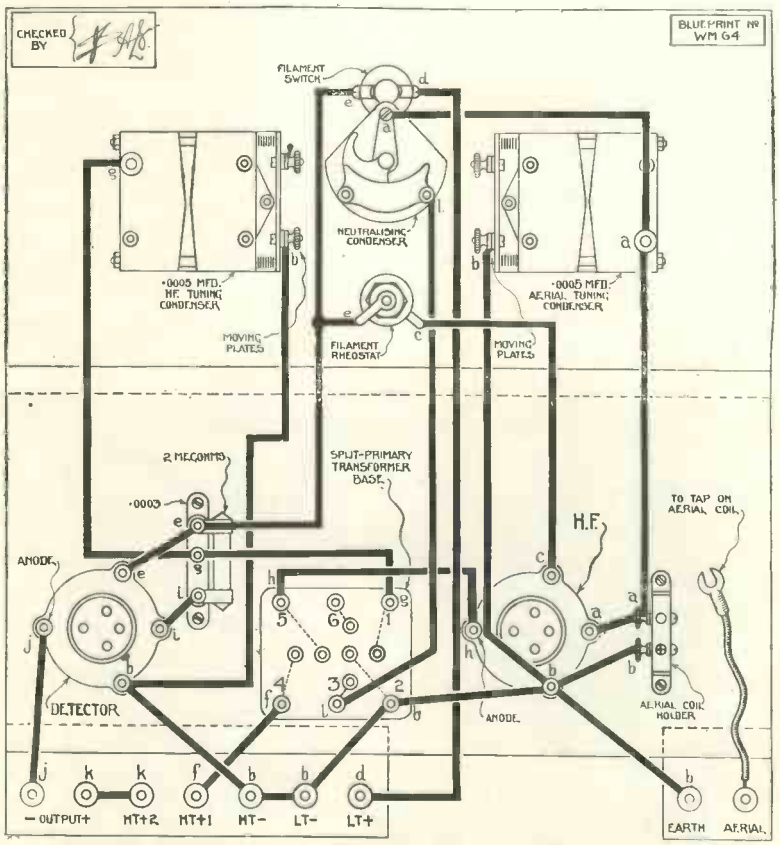
No components that cannot be readily obtained from the average wireless dealer are required for the construction of this receiver, as can be seen from a glance at the list reproduced on page 350. It should be noted that whatever grid condenser is used, provision must be made for series connection of the grid leak and not parallel connection.

As far as possible constructors are recommended to follow the original specification (the names that appear first in the brackets are those of the manufacturers whose parts were used in the original construction; following are recommended alternatives which will fit the available spaces).

Although all the essential details are reproduced in these pages, a large number of those who build this receiver will be glad of a full-size blueprint drilling guide, layout and wiring diagram. One of these can be obtained for half-price, that is 6d., post free, up till May 31, if the coupon on page iii of the cover is used.

Ask for blueprint No. WM64 and address your inquiry to Blueprint Dept., WIRELESS MAGAZINE, 58-61 Fetter Lane, E.C.4.

When all the parts have been obtained begin the construction by drilling the panel and mounting thereon the panel components. These include the two .0005-microfarad variable condensers, on-off switch, neutralising condenser and filament rheostat.



This wiring diagram can be obtained as a full-size blueprint for half price, that is 6d., post free, if the coupon on page iii of the cover is used before May 31.

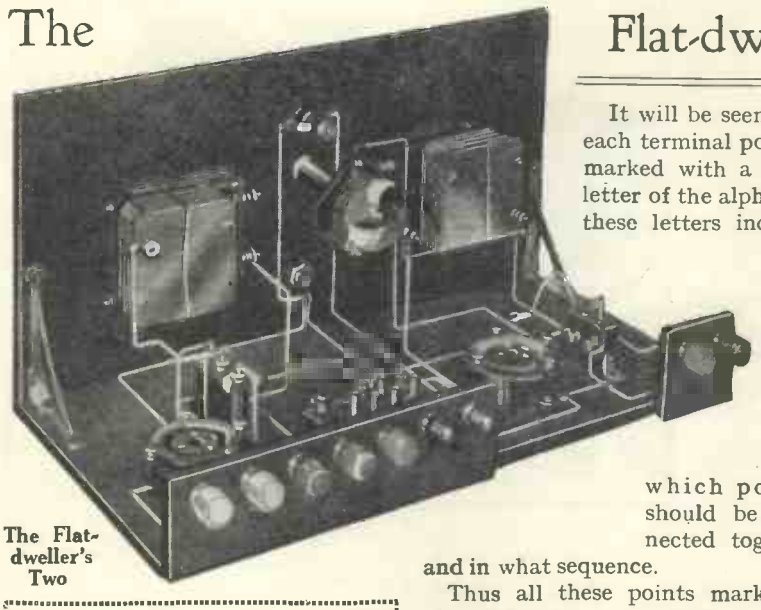
Mounting the Panel

The next step is to fix the panel to the baseboard by means of brackets and screw the terminal strips on the back edge of the baseboard. Then all the baseboard components can be firmly screwed down.

These are arranged almost in line and, looking from the front of the panel, are: Aerial coil holder, high-frequency valve holder, high-frequency transformer holder (six-pin base), grid condenser and leak, and detector valve holder.

As soon as all the components have been fixed in position, wiring-up can be started; this operation will be facilitated both for experienced amateurs and novices alike by the use of a blueprint, although a wiring diagram is reproduced on this page.

The Flat-dweller's Two (Continued)



The Flat-dweller's Two

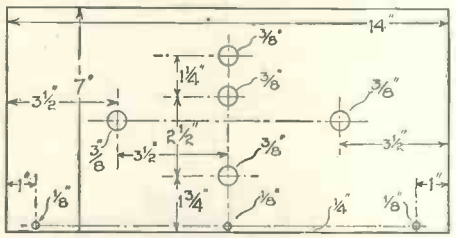
COMPONENTS REQUIRED

1—Ebonite panel, 14 in. by 7 in. (Paragon, Red Triangle, or Raymond).
2—.0005-microfarad variable condensers (Ripault, Igranic, or Dubilier).
1—On-off switch (Lissen, Lotus, or Benjamin).
2—Vernier dials (Ripault, Igranic, or Formo).
1—Panel-mounting neutralising condenser (Peto-Scott, or Igranic).
1—Single coil-holder (Lotus, Lissen, or Burne-Jones).
2—Anti-microphonic valve-holders (Bretwood, Lotus, or Benjamin).
1—6-pin coil base (Lewcos, Wearite, or Peto-Scott).
1—.0003-microfarad fixed condenser (T.C.C. type S.P. or Dubilier with series clip).
1—2-megohm grid leak (Lissen, Dubilier, or Mullard).
2—Ebonite terminal strips, 2 in. by 2 in. and 7¼ in. by 2 in. (Paragon, Red Triangle, or Raymond).
1—Pair panel brackets (Carrington, Bulgin, or Burne-Jones).
1—Cabinet and baseboard, 7 in. deep (Artcraft, Carrington, or Pickett).
4—2-ft. lengths of Glazite for wiring.
1—Length of flex with spade tag.
9—Terminals, coloured as follows: green, grey, red, black, blue, yellow, orange, mauve, white (Clix).
2—6-pin split-primary coils, one for each wavelength band (Lewcos, Wearite, or Peto-Scott).
2—Centre-tapped coils, Nos. 60 (or 75) and 150 (Atlas, Lissen, or Igranic).
1—6-ohm panel mounting rheostat (Benjamin, Lissen, or Igranic).

It will be seen that each terminal point is marked with a small letter of the alphabet; these letters indicate which points should be connected together and in what sequence.

Thus all these points marked *a* should be first connected together with one wire or as few wires as possible; then the points marked *b* should be connected; and so on through the alphabet.

The method of connecting up the grid-leak should be particularly noted especially if a grid-condenser of different pattern than that used in the original receiver is used. If an insulated clip is not used for one end of the grid-leak, the low-tension supply will be short-circuited through the secondary winding of the high-frequency transformer. It is best to use the same component as incorporated in the original set.



Panel layout of the Flat-dweller's Two, not required if a blueprint is used

Coloured Terminals

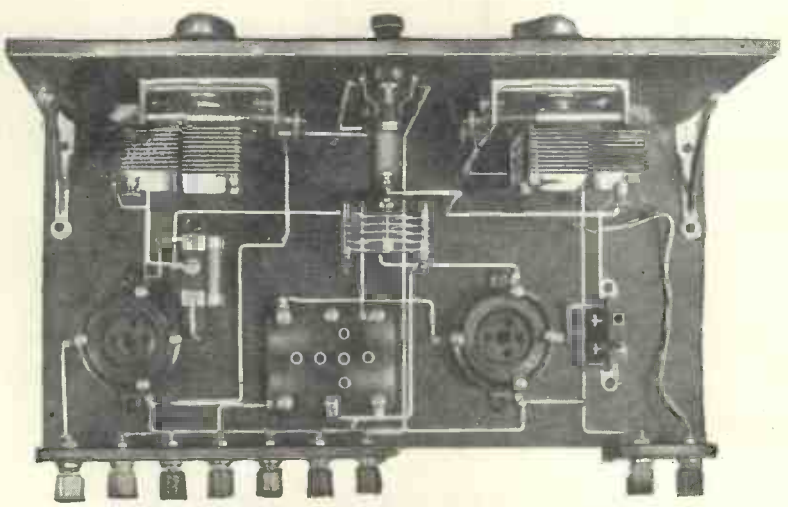
Coloured terminals have been used in this receiver; these are of considerable convenience once the colours are memorised, as they are all different. An arrangement that the WIRELESS MAGAZINE Technical Staff found to be convenient was as follows:

Aerial, green; earth, grey; L.T.+, red; L.T.−, black; H.T.−, blue; H.T.+1, yellow; H.T.+2, orange; output+, mauve; output−, white.

Normally, of course, when the Flat-dweller's Two is used on its own a pair of headphones or a loud-speaker will be connected across the terminals marked "output."

Suitable coils for use in this receiver are indicated in the list of components. It is difficult to recommend one particular size of aerial coil as so much depends upon the size of the aerial.

It might be thought that with a short indoor aerial a larger aerial coil than usual would be required, but this is not always the case as the capacity of an indoor aerial is in many instances greater



Plan view of the Flat-dweller's Two, which clearly indicates the disposition of the components

For An Indoor Aerial

than that of an outdoor aerial.

Results depend as much as anything on the use of suitable valves. The first valve, that is, the high-frequency amplifier, should have an impedance of 20,000 to 30,000 ohms. The second valve (the detector) can be of approximately the same impedance if the set is used on its own and not in conjunction with a low-frequency amplifier; an impedance more in the neighbourhood of 20,000 ohms than 30,000 ohms will, however, be found best in most cases.

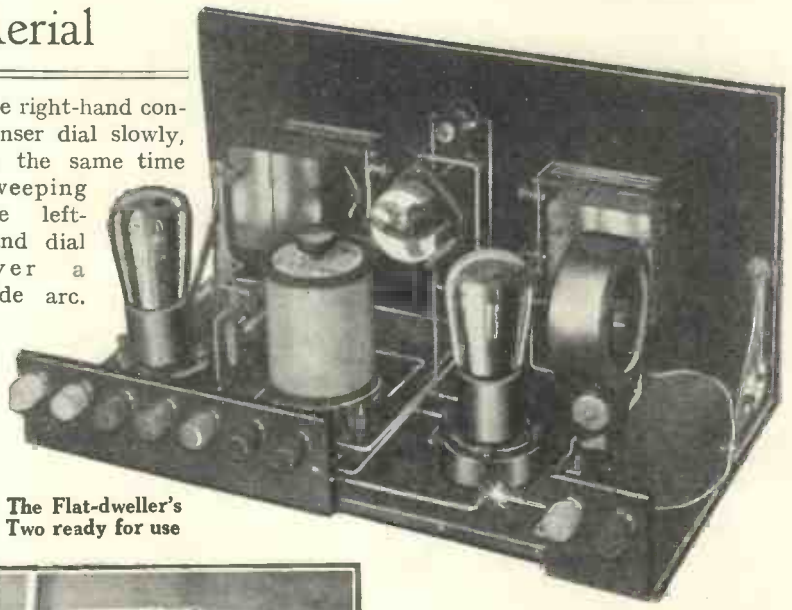
With An External Amplifier

When the set is to be used in conjunction with a low-frequency amplifier, the choice of a detector valve will, of course, be influenced by the type of coupling employed.

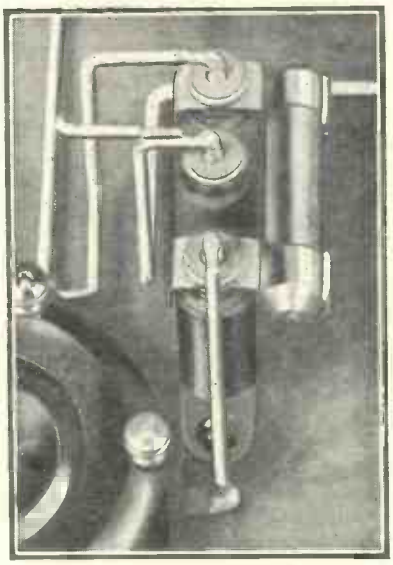
With a 4-to-1 ratio low-frequency transformer use a valve with an impedance of about 15,000 to 20,000 ohms. In the case of a resistance-capacity coupled amplifier the detector-valve impedance should be about one half or one third of the anode resistance employed.

Whether this set is used with an amplifier or not it is recommended that it should first be tested out on its own. Insert a suitable tapped coil and high-frequency transformer in their respective holders, not forgetting to connect the flex attached to the aerial terminal to the aerial coil. Also place the two valves in position.

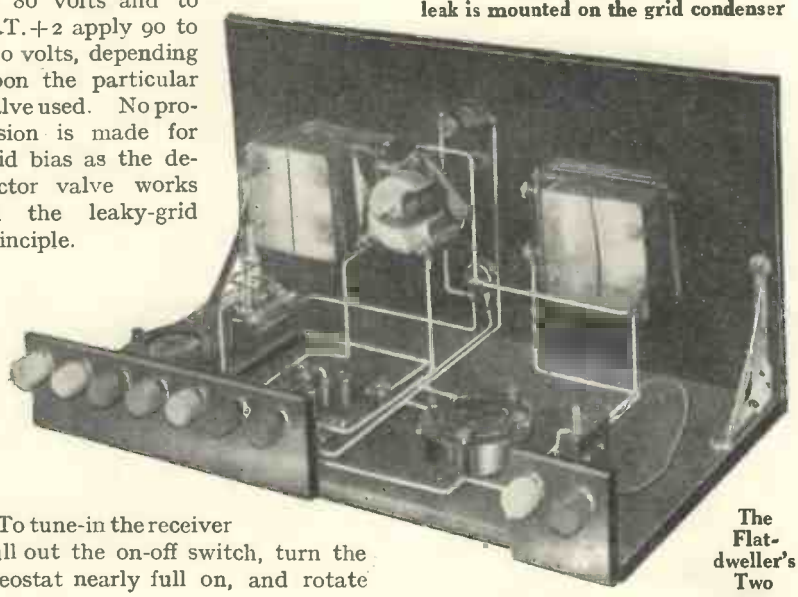
To H.T.+1 apply a potential of 60 to 80 volts and to H.T.+2 apply 90 to 120 volts, depending upon the particular valve used. No provision is made for grid bias as the detector valve works on the leaky-grid principle.



The Flat-dweller's Two ready for use



This photograph shows how the grid leak is mounted on the grid condenser



The Flat-dweller's Two

To tune-in the receiver pull out the on-off switch, turn the rheostat nearly full on, and rotate the right-hand condenser dial slowly, at the same time sweeping the left-hand dial over a wide arc. Carry on in this way until a station is picked up. Adjust both tuning dials until the greatest signal strength is obtained.

Neutralising the H.F. Valve

In order to neutralise the high-frequency valve, it is necessary to switch off the filament, but the valve must not be moved from the holder. The valve can be conveniently switched off by removing a lead from one of the filament terminals.

When this has been done, manipulate the knob of the neutralising condenser until signals become quiet or almost inaudible. Proper neutralisation is not being carried out, as a matter of fact, unless signals do become quite inaudible. When this operation has been completed satisfactorily the valve can be switched on again.

Used in conjunction with a two- or three-valve amplifier the Flat-dweller's Two will constitute a powerful receiving combination. It is essential, however, that in the amplifier itself high-tension negative is connected to low-tension negative, and *not* to low-tension positive.

Short-circuited Accumulator

If the two units are used in combination and high-tension negative in the amplifier is connected to low-tension positive (as is sometimes the case) the accumulator will be short-circuited when the set is switched on.

Once again, the reader is warned that this set used by itself is only suitable for headphone work.

5YM—the Well-known Experimenter—Writes on

An Interesting Short-wave Experiment

HERE is an interesting experiment for those who can fix up two short aerials and have a smoothly working short-wave receiver. Arrange one aerial so that it is, as nearly as possible, vertical. This can best be done by using the main aerial as a support for the free end. Now fix up another of about the same length so that it is horizontal and has as little down-lead as possible.

From One Aerial to the Other

If time is available one of the two wires should be adjusted until some station that is working constantly can be heard, without changing the tuning, when the set is switched from one aerial to the other. If this job is too difficult it can be got over by noting the change of tuning necessary when changing aerials.

Having fixed your two aerials you will find out many interesting things. Some stations will come in better on the vertical arrangement and some on the horizontal arrangement. For a really true test, of course, the two aerials should be so put up that their mean electrical height is the same, and also their wavelength; but this will probably be beyond most experimenters.

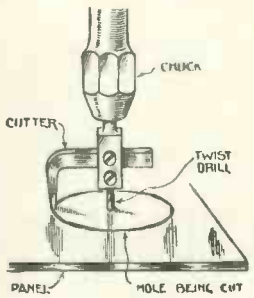
Just to have the two aerials, however, will prove of great interest, and they are well worth playing with for a month or two. The curious thing is that they don't seem to behave with any constancy. Sometimes, for instance, 2XAD will come in better on the horizontal wire and sometimes better on the vertical wire. Generally speaking, however, in my experience, the vertical wire is the better collector.

Short-wave Broadcasts

I have been doing a great deal of listening to the short-wave broadcast stations recently—still sticking to my H.F. stage, which I would not be without—and I find that the majority of the better-known stations can almost always be heard without any trouble at all.

The Monday morning transmissions from 3LO (Melbourne) which we hear on Sunday afternoons, after tea, have been very consistent since the beginning of the year; but at the end of March they seem to be getting a little difficult to pick up. The Dutch Indies station, ANH, in Java, I have heard on one or two Sundays between 2 and 3 o'clock in the afternoon; but this 17-metre transmission can hardly be called one of the really dependable ones. It is well worth seeking for, however, and it is quite likely that it will increase in strength as the year grows older.

A DRILLING HINT



Above is illustrated the quickest method of cutting holes in ebonite panels to accommodate milliammeters and other instruments that take up a large amount of space. Cutters of the type shown can be bought cheaply at most tool shops; they very soon pay for themselves by saving time and temper

Most Remarkable Station

One of the most remarkable stations is 2XAD on 21.96 metres. This always seems to be at good strength and very seldom suffers from really severe fading. It can be heard from 7.0 p.m. on Mondays and Thursdays and from 11.30 p.m. on Sundays, Wednesdays, and Fridays.

Never have I heard it, though, at night so loud and steady as it is in the afternoon, when there is broad daylight over the Atlantic. On many afternoons in February I was able to tune it in at weak loud-speaker strength on three valves and could hear every word said at four or five feet.

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There are many natural difficulties in the way of really "safe and certain" reception of long-distance telephony on short waves. Whether we shall, some time or other, be able to get over these difficulties I do not know; but as we have no real knowledge of the causes of some of the difficulties a complete solution seems to be far off.

What Is Fading Due To

Even when we have tied down the frequency of the transmission with a crystal or tuning-fork control we still have to contend with fading in all its varying degrees and kinds. So far as we know most fading is due to the fact that the angle at which the waves are reflected from or refracted through the conducting layer in the upper atmosphere may vary from time to time.

This would account for irregular fading quite well; but it does not account for those types of fading which come at regular intervals, nor does it account for "high-speed" fading. This may be due to the fact that very short waves will often travel two or three times round the world. The rapid impingement of one modulated wave on another causes interference. Sharply tuned continuous-wave morse does not suffer to the same extent.

Four-electrode Experiments

I have recently been experimenting with four-electrode valves—not the now familiar screened-grid type—for short-wave reception, and am finding them very successful. I had hoped to have completed my experiments in time for this month's notes, but have not been able to do all I want to do, and so I will have to put off my complete report until next month.

I must say, however, that I find certain types remarkably efficient in our familiar Hartley and Reinhartz circuits where they allow the use of a high-amplification detector with excellent results. The chief advantage of the four-electrode valve is, of course, that it can be worked with a very small H.T. voltage, which makes it particularly useful in the building of small portable receivers.

Rebellion Amongst Amateurs

There is every sign that established amateur transmitters are beginning to rebel against QSL cards, which are nothing less than a nuisance to a busy experimenter. The familiar post card was undoubtedly of great use in the early days when we did not quite know what we were doing; but now that contacts are so sure and one can get all the necessary information at once from the man with whom we are working it does seem unnecessary to follow the contact with a card.

My Own Rule

My own rule, which seems to me to meet all the needs of the case, is only to send cards to beginners, to non-transmitting amateurs who send me reports, and to stations over 3,000 miles away. In the latter case I always ask whether a card is wanted and state whether I want one myself. I do not want a card unless it is from a part of the world I have not previously "worked," when the card is useful as a record of the fact that another country has been added to the list of those received.

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Up to date we have had no information as to the line our Post Office authorities intend to take on the question of the new amateur wavelengths allocated by the Washington Conference. I presume that we shall fall into line with the rest of the world, and that the change will be made on January 1 next year, since our representatives at the conference agreed to the allocations.

Working in Narrow Limits

It will not make much difference to us, as we are already used to working to fairly narrow wavelength limits; but we shall certainly be rather more crowded together and new methods will have to be developed. One thing is certain—we shall have to completely eliminate any modulation of the note on morse and all strive for pure "D.C.C.W." We shall also have to limit the wavelengths on which telephony stations may work if we are to continue with our experimenting.

Do You Believe in the Heaviside Layer?

RECENT experiments with short-wave beam transmissions seem to have put an end to any doubt there may still have been with regard to the existence of the Heaviside layer.

At Nauen, in Germany, signals from a short-wave transmitter of 15 metres wavelength have actually been sent round the world and recorded after their journey at a point very near to their starting point.

The time taken for these signals to travel round the world was a little more than would be expected, assuming that the waves had travelled over the surface of the earth. In fact, the time was such as to suggest that the waves must have travelled at an average height of a hundred miles above the earth's surface.

Since the waves started from the surface, travelled through the upper regions of the atmosphere and returned to the surface, something must have turned them back to earth—that something being, of course, what scientists have called the Heaviside layer.

Composition of the Upper Atmosphere

The theory of the Heaviside layer is an ingenious one, but scientists have still to tell us definitely what the atmosphere is composed of at the height of the Heaviside layer. It is generally supposed that, at heights above a hundred miles, the atmosphere is composed of hydrogen with a little helium, though some investigators claim that the upper atmosphere is made up entirely of helium.

AERIAL.

Get Ready To Go Outdoors !

Now is the time for all good amateurs to prepare for countryside excursions, the pleasures of which can be enhanced beyond all expectations with a good radio set

JAY COOTE, the European Broadcasting Authority, Tells You

What you ought to know about CONTINENTAL RADIO

DO you ever listen to the programmes broadcast by Vienna? Personally, whenever I find an opportunity for doing so I do not miss it for the Austrian station puts on the air almost nightly some of the best entertainments to be found on the Continent. It is unfortunate, however, that Rosenhuegel should have been blessed—or should it be cursed?—with a wavelength so near to the ship band, as at times in the middle of a relay from its excellent State Opera House the transmission at intervals is "Morsed" to death.

New Super-power Station

However, there is a possibility that this difficulty may be overcome by the advent of the new super-power station with which the Austrian capital is to be endowed. In many respects the new transmitter will be a sister to the German Zeesen; it is to possess the same power—some 35 kilowatts—is built by the same engineers, and possesses the advantages of certain improvements which have been incorporated since the new Koenigswusterhausen officially took the air.

Although it is doubtful whether another wavelength will be allocated to it, it is to be hoped that its power will overcome ordinary Morse signals; they may still be present in the form of a disturbing background, but their interference should not prevent good reception of the transmitted programmes in the United Kingdom.

Summer Broadcasts

With the prospect of possessing the second most powerful station in Europe, Radio-Wein is already preparing an interesting series of summer broadcasts; in fact, from what I can see, new studios are to be built, the service extended, and the magnitude of the entertainments are all to be in keeping with the size of the new toy.

Vienna, as an example, contemplates a monster fête, to take place during the period July 16-26, when there is to be a convention in Austria of a large number of German choral societies. To stage the concerts a hall of gigantic proportions capable of accommodating an audience of 30,000 spectators is to be built in the neighbourhood of the Vienna Prater—the Coney Island of the Austrian capital. The stage alone will be planned to take massed choirs of 20,000 singers and an orchestra of some four hundred musicians!

It is said that over 120,000 members of choral societies from Germany have already entered for these competitions, a further 28,000 from neighbouring countries, and that over 4,000 German-speaking Americans have notified their intention to cross the Herring Pond with a view to assisting at the festival. By means of the new 35-kilowatter Vienna hopes to broadcast this monster fête for the benefit of Europe at large.

Special Celebrations

Moreover, in Austria, 1928 is Schubert year, the celebrations of which reach their climax in November next; special entertainments are being arranged for performance during that month, and will be relayed to the giant transmitter.

Although to most radio fans in this country the Buda-Pesth programmes are out of reach, the linking up of the Hungarian capital by landline to Vienna, and the consequent exchange of radio entertainments between the two countries, in future, will add a further series of distant broadcasts to our daily fare. Through Vienna and Buda-Pesth, we shall also be connected to Prague and Warsaw.

The installation, in most European States, of high-power transmitters must assist considerably in bringing to our ears the best talent of the individual Continental capitals.

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Of the numerous private transmitters now operating in France, Radio Toulouse is, I think, the one which shows the most enterprise and initiative. Almost from the day on which it broadcast its first transmission, it has been beset with difficulties and numerous are the obstacles which have been placed in its way by the French PTT officials.

South Badly Served

The South of France is badly served by broadcasting stations, and Radio Toulouse is the one transmitter to which the fans resident in Lyons, Marseilles, or other less important cities may turn daily for a fairly comprehensive programme of wireless entertainments.

Radio Toulouse, in the face of local official competition, has managed to hold its own for some three years, and appears to have been given the wholehearted support of the neighbouring municipalities, and the surrounding country-side. Even telephone landlines have been refused to the studio, and for its regular tri-weekly relays of performances from the *Théâtre de la Capitole*—the principal house of amusement in that city—it has been compelled to resort to the system which the B.B.C. in the early days of broadcasting adopted for picking up entertainments from the Old Vic, in the Waterloo Bridge Road.

Theatre Relays

At the *Théâtre de la Capitole*, a small 200-watt transmitter has been installed; microphones have been placed near the footlights, and in the auditorium, and on wavelengths varying between 130 and 205 metres the performance is relayed by wireless link to the main 3-kilowatt transmitter erected at the Villa Schmidt, some two and a half miles distant from the city.

It was found necessary to adopt three wavelengths, namely, 130, 165, and 205 metres, and to use them at random on different evenings for the sole reason that in the early days of the experiment, interference was

caused by amateurs desirous of picking up the transmission from the theatre aerial direct.

Purity of Transmission

I have listened to these broadcasts —they are given on Tuesdays, Thursdays, and Sundays—on many occasions, and have wondered at the purity of their quality. Now and again they are subject to some slight fading, but at no time has defect greatly interfered with good reception.

Lille, too, or Radio PTT Nord, as it is called locally, shows more enterprise than any of the other official transmitters. The studio possesses an energetic director, who in his turn possesses vim, push, go and the other necessary attributes of a successful showman—a big asset to a young broadcasting station.

Within a year he appears to have distributed microphones all over the surrounding landscape, and has linked up his transmitter to some twenty different localities. Apart from these excursions abroad, in order to give his local audience samples of the programmes broadcast by foreign studios at regular intervals he taps the ether, and serves up hot to his subscribers, at very short notice, choice morsels of the entertainments provided by British, Belgian, German, and Spanish studios.

A Radio Statue ?

According to local reports the inhabitants of Lille contemplate the erection of a statue to their radio organiser; the rumour, however, lacks confirmation, but the fact remains that most of the other official provincial studios are content to take the bulk of their entertainments from the mother station (*Ecole Superieure*) at Paris.

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How many of the Polish transmissions can you pick up nightly? Personally, both Warsaw and Cattowitz are always at my beck and call; I can listen to their transmissions on a loud-speaker at any time of the evening. The programmes from Cracow, Posen, and Wilno, on the other hand, are only within my reach when the B.B.C. stations are resting.

Increased Power

That we shall hear most of these transmitters in the near future cannot be doubted, for in most instances their power is to be increased. Wilno, for instance, for the present has its broadcasting plant on loan pending the erection of a 5-kilowatter; Warsaw is to spread itself in the ether at an early date, and work on the Lemberg (Lvov) station is rapidly nearing completion. But, even with this programme, Polskie Radio is not content, for the authorities now contemplate the opening of a "radio branch" at Graudenz, formerly West Prussia, a town on the right bank of the Vistula, situated some sixty miles south of Danzig.

Background of Polish News

The advent of Cattowitz considerably perturbed the inhabitants of Breslau and Gleiwitz, who heard their local programmes with a background of Polish political news; the news that a 5-kilowatt transmitter is to be opened within "one valve" range of Danzig will not tend to cheer up the licensed listeners of that free city.

◆ ◆ ◆

Although but little is heard of the development of the Russian broadcasting system, it appears that the Soviet authorities are by no means resting on their laurels. Many are the radio fans in this country who are able to pick up the Moscow Komintern transmissions from the super-power station in that city, and on the East coast of England, Leningrad is regularly received.

But little was said at the time of the opening of the new Kharkov-Narkompotschtel 15-kilowatt station, but it also bridges the gap, and during the winter evenings, it was possible to pick up its relays of performances from the local opera house. The question of installing in some favourable district in Russia a giant 300-kilowatt station has again cropped up; during 1927, rumours regarding this proposal were persistent although contradicted in more than one quarter.

A Practical Scheme

I understand that Russian engineers consider the scheme a practical one, and that the authorities have decided to back it. Plans have also been put forward for the extension of radio in the land of the Soviets during 1928—1929; on January 1 of this year, some sixty-five stations were already in operation in that country; in 1920 there were only three. Some progress, indeed.

But the country is a huge one; licences are cheap, and in most districts wireless entertainments are the only source of recreation during the long winter nights. The Russian official factories, dealing with radio components, are to-day producing 150,000 crystal and valve receivers in the course of twelve months.

So great has been the demand for components to be used for the home construction of sets that further works have been adapted to cope with requirements. In an official report it is stated that the authorities will allot to the radio industry during the present year a sum which may exceed half a million sterling.

A QUINTET OF POPULAR BROADCASTERS

These are the members of Geoffrey Gelder's Kettner's Five

Of Special Interest to Constructors of The Music Charmer

How to Polish Your Cabinets

IN dealing with a subject that may include every branch of cabinet-making it is well to state what is taken for granted. In this article it is assumed that a plain box-like cabinet, either of white wood or some choice wood, has already been constructed to the required dimensions.

It is also assumed that the cabinet has been *screwed* together, and each screw countersunk so that its head lies about $\frac{1}{16}$ in. below the surface of the wood. This article explains how from that foundation a handsome polished cabinet may be built up.

Ornamentation

First, as to its ornamentation. Lengths of moulding may be glued down the two edges of the cabinet formed by the two sides. This moulding should be of a width corresponding to the thickness of the wood formed by the sides.

If the cabinet includes a battery compartment a small drop handle will be wanted; this may be purchased in brass, nickel, or bronze. The holes for this handle should be drilled, but it should not be screwed down until the polishing is completed. Any door hinges must be put into place and the door tried to see if it hangs correctly, but it must not be permanently hung until all the polishing is done.

Suitable Stains

Before describing the processes of staining and polishing we will deal with stains in themselves so that you may know what to buy. The following list will serve most purposes:

STAINS FOR WHITE WOOD

MAHOGANY

1 oz. Red Sanders to ¼ pint methylated spirit.

WALNUT

Handful of washing soda in quart water, add brown umber until desired colour obtained.

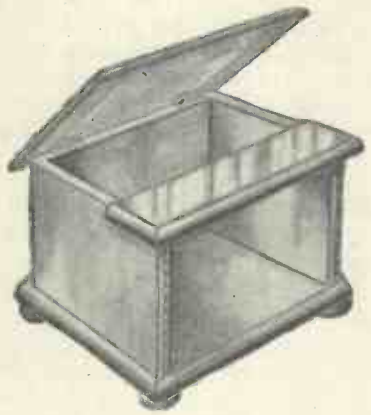
OAK

½ oz. permanganate of potash in ½ pint of rain water. 2 or 3 coats.

FOR CHOICE WOODS

MAHOGANY

1 oz. alkanet wood to ¼ pint linseed oil. Wipe over with rag.



WALNUT

Light: Wipe with linseed oil.
Dark: Treat as if white wood.

OAK

Treat as if white wood, but with fewer applications.

TEAK

¼ oz. Bismarck brown, in 1 pint of hot water and vinegar (equal parts).

Always test a stain on a piece of spare wood before using. To obtain the right colour several applications may be needed. After straining, glasspaper and then rub a little linseed oil into the grain.

Two Polishing Methods

There are two methods of polishing the stained wood. The first is very slow, taking several weeks to complete. The wood has to be daily treated with linseed oil, the oil being applied with a rag every day for at least a month. The cabinet should then be left to harden, when it will be found that an extremely hard and beautifully polished surface has formed.

The second method is the well-known one of french polishing. But before the cabinet can be french polished it is essential that the grain be filled. A grain filler is formed by mixing fine whiting and turpentine into a paste. This paste should then be coloured to match the stain which has already been applied to the wood. The resulting grain filler must be rubbed into the wood across the grain. All countersunk screw holes should be stopped with this filler.

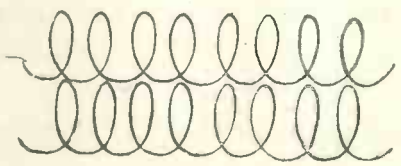
For use upon mahogany tint with venetian red, for walnut tint with brown umber, and for all light wood like elm tint with yellow ochre. When dry glasspaper quite flat.

The actual work of polishing may now be started. The french polish may be obtained at any oil-shop, and is used with the following rubber: Take a piece of clean rag and lay it flat upon a piece of wood, then taking a fairly small piece of wadding and squeeze it in the hand until it assumes a convenient pear-like shape. Lay this wadding upon the rag, pull the rag up and over the wadding and you have the rubber.

Charging the Rubber

In folding the rag be careful that no creases form on the working face. For use the rubber must be charged with polish, and in doing this care must be taken. The covering of rag is opened so that a little polish may be dropped upon the wadding. A little pressure upon the rubber will now cause the polish to ooze out slowly and evenly.

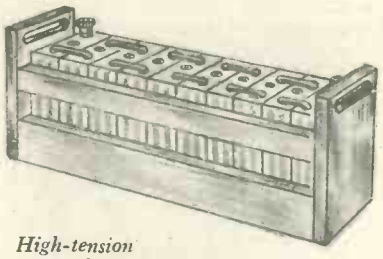
The polishing is done by quickly wiping over the entire surface of the portion of wood to be polished, squeezing steadily the whole time. First work against and then with the grain. The motion of the rubber should take the form of circles, and so its path will be something like this:



Quite Simple Really

Never let the rubber rest upon the work, always keep rubbing lightly until the polish is quite dry. A fine hard polish will be left. All this sounds very complicated, but if you first try your hand on an odd piece of wood you will soon find it quite easy. The beauty of french polish is that it never marks, and will retain its polish for a great length of time.

R. W. T.



High-tension accumulators are excellent for supplying power to valve anodes

You Must Not Starve Your Anodes!

QUITE a number of people seem to think that it is a sign of skill as a wireless "expert" if they can operate their sets on phenomenally low H.T. values. In the days of bright emitters the game was always to use as little low-tension as possible, and the man who could receive even the local station on the loud-speaker, with the valves a dull red glow, was considered a "super" radio operator.

No Merit in the Popular Craze

Nowadays, though, valve gettering hides the filament glow (if it glows at all, that is, and many do not), and so no credit is attached to cutting down the L.T. The craze for cutting down the H.T. is still popular, although there is no merit in it.

After all, nobody really minds what a set is like inside, how it is adjusted or made, provided that it does what it was designed to do—that is, work.

With modern resistance-coupled amplifiers and low-impedance power valves neither good strength nor quality can be had without ample anode "juice."

It should be remembered that the makers' maximum H.T. rating for a valve (120 volts, say) is the maximum voltage which should be *actually applied* to the plate. If high resistance and high-impedance chokes and resistances are included in the anode circuit, the *effective* H.T. at the valve plate may be less than half that at the battery terminals.

Not only is ample voltage very necessary, but consistently good quality with most sets demands an H.T. supply of large capacity. Hence the popularity with the *cognoscenti* of H.T. accumulators and super-capacity dry cells.

Mains eliminators score in this respect, in that their voltage and amperage is, to all intents and purposes, constant. Make sure, though, that the eliminator you have is large enough for the set it supplies. It is asking for trouble to use a "juice box" recommended by the makers for a two-valver on a multi-valve outfit.

Heavy Currents Needed

Large power valves demand a fairly heavy anode current and if the H.T. eliminator cannot supply this then the position will be worse than if a miniature and run-down dry battery were used.

Summed up, the foregoing facts mean that ample anode voltage and current is a *sin qua non* for good reception. There is nothing particularly "clever" in working a set on less than its rated amount of H.T.

QUEUE.

IS IT OVER-CHARGED?

OVER-CHARGING of an accumulator does not have such a marked detrimental effect upon it as does constant total discharging. After a while, though, excessive charging will as assuredly damage the plates of a battery as if it were frequently allowed to drop below the minimum of 1.8 volts per cell.

This will not cause those who send out their batteries to be charged to suffer from sleepless nights of worry! If you run a home-charger of any type, though, it is just as well to make quite sure that accumulators are not consistently given too long a charge.

There are three indications given when a battery is fully charged.

First, the voltage per cell will be in the neighbourhood of 2.6 volts, and this will quickly drop to 2.2 or 2.1 volts when a light load is placed upon the cells.

Second, the specific gravity, when tested with an hydrometer, should be about 1.2.

The specific gravity of the acid rises, of course, in some relation to the voltage and state of charge of a cell.

Third, most batteries "gas" freely when fully charged. This is not a very positive indication, but is a point to note as a time-saver. If a battery is known to gas when fully charged, it is waste of time to test the voltage or specific gravity unless the acid is "bubbling" freely.

I. W.

A FORECAST

My dear, I was so thrilled last week,
I saw a Paris dress parade,
The mannequins were very chic.
Did I fly over? No, I stayed
In London, where, as advertised,
The dress parade was televised!

LESLIE M. OYLER.

THE GRAMO-RADIO FOUR

(Continued from page 340)

G.B.—1 apply 3 to 4½ volts negative bias and to G.B.—2 about 6 or 9 volts.

For tuning-in on the low wavelength band, pull out the "change" knob of the tuner, push the loud-speaker plug into the jack and manipulate the variable tuning condenser until the local station is picked up. Then adjust the reaction and volume controls until the required strength is obtained from the loud-speaker.

These controls and the grid bias must be so adjusted that the milliammeter gives a constant reading and does not flicker. If the needle does flicker at all distortion is taking place.

To change over to a gramophone just connect an electrical pick-up to the appropriate terminals and pull out the left-hand switch knob. It may, of course, be necessary to readjust the volume control.

Broadcast Music of the Month

Reviewed by "Studius"

ONE cannot speak too highly of the music heard recently from Mr. Frank Ashworth's fine Castle Band at the Park Lane Hotel, Signor Moschetto's Orchestra at the Savoy, M. Emilio Colombo's Orchestra, so finely led by Signor Mantovani at the Hotel Metropole, and M. Rene Taponniere's Orchestra at the Carlton Hotel. All these play both popular and classical music.

Kettner's Five

Another popular combination is the quintet of players known as Kettner's Five, led by a brilliant violinist, Mr. Geoffrey Gelder. Only those fortunate enough to possess a set that really takes in Daventry, however, are able to take advantage of their performances.

Organ music, though by no means the best broadcasting material, is fast becoming a vital element in the programmes.

Recently we have heard Mr. Pattman from the Astoria, while Reginald Foort, who used to be heard from the New Gallery, is now being relayed from the Palladium on Saturdays for a half-hour recital starting at 6 o'clock.

"Feature Concerts"

Amongst what may be termed the really big "feature concerts" of the month mention must be made of the two final National Symphony Concerts at Queen's Hall, a series which it is hoped may be possibly renewed, classical in character though they have been. That on Good Friday was appropriately devoted to Wagner's religious music-drama, "Parsifal." The final one, on April 20, when Sir Henry Wood again conducted, included a noteworthy item, the promised first performance in England of the "Israel" symphony by Ernest Bloch.

Opera has been comparatively conspicuous by reason of its absence, the only outstanding events being the performance of Gluck's seldom heard *Armida* and Mozart's opera, *Cosi fan Tutte* (The School for Lovers).

The vocal element is, as usual, the strongest side of the programmes, and many well-known names and early broadcasters have been heard frequently during the month. Special mention should be made of Mme Raymonde Amy and also Mr. Alan Johnstone, both original members of The Celtic Singers; both are fine soloists, as well as being good in concerted numbers.

Other Fine Singers

Muriel Brunskill, Eda Bennie, Gertrude Johnson, Walter Widdop, Hubert Eisdell, and Horace Stevens have been heard; all are great singers and have redeemed many a programme for us.

Linda Seymour, Singer

Harold Kimberley, Vocalist

"John Overton," Author & Composer (right)

Olive Sturgess, singer

But apart from these, who are mainly recruits from the operatic stage, there have been many other excellent voices broadcast. Miss Helen Henschel, daughter of Sir George Henschel, has given many solo recitals. John Booth, Harold Kimberley, A. E. Cruickshank, Elsie Black, Linda Seymour, Norman Archer, and Olive Sturgess are all familiar names to listeners, and their choice of songs fairly popular.

Some Famous Soloists

One turns to the list of soloists with relief, for here we have certainly heard some of the most famous players in the world's music. The pianists have included Solomon, Leff Pouisnoff, Leopold Godwosky, Johanne Stockmarr, and Cecil Bamer, while in violinists we have had splendid work from Melsa, William Primrose, Albert Sammons, and Frank Cantell, leader of the Birmingham station orchestra.

Elsie Black, singer

Richard Wassell, conductor of City of Birmingham Police Band

Other solo artistes are Miss Beatrice Eveline, 'cellist; Mr. Samuel Clifford, of the Bournemouth Municipal Orchestra and Broadcasting station; and Beatrice Harrison, the famous 'cellist.

The latter joined issue with George Parker (baritone) on April 18, for a special programme of John Ireland's music, the composer himself being at the piano.

Another concert of interest was that arranged by Mr. Percy Pitt for April 10, when Claire Croiza, a French pianist, came over specially for the programme devoted to Ravel's work.

Many complaints are heard about the preponderance of plays in the programmes, and dull ones at that. As an example of the latter may be quoted the German play, *Der Rampa*, by Max Molnar, though possibly in its screen form as *The Wild Man* it may attract more attention.

A. E. Cruickshank, baritone

Mary Willetts, B.A., reader

Two new radio playwrights are Holt Marwell and Cyril Lister, and their play, *The Crossing*, will no doubt be heard, and possibly seen, again.

Appeals have been made by several theatrical stars, including Sybil Thorndyke and Margaret Halstan. The former was heard in Euripedes' play, *Medea*.

On the lighter side one was glad to note the re-appearances of John Henry, the B.B.C.'s own humorist, and George Robey, who brought some of his *Bits and Pieces* from the Prince's Theatre, and included in his cast one of our cleverest comediennes, Marie Blanche.

Helen Henschel, singer

The talkers have been far too numerous, but chief in merit must be mentioned Captain Eckersley, whose fifteen minutes should certainly have been thirty. Up in the north was heard Miss Mary Willetts, B.A., and Estelle Steele Harper, an authority on art subjects.

A Shavian Play

Speeches of Mr. Bernard Shaw have been broadcast before, but a triumph was scored with the performance of his play, *A Man of Destiny*, broadcast by the MacDona Players in the London studio.

Mr. Jeffery Farnol, the novelist, best known, perhaps, for his book, *Amateur Gentleman*, wrote a new play specially for broadcasting, entitled, *A Woman's Reason*, which should be heard again.

Estelle Steele Harper, talker on art matters

A View of Waterloo Station

Courtesy of the Southern Railway Co., Ltd.

THERE are indications that the Wireless Age has not left the railway companies unmoved and that certain interesting developments in the adoption of broadcasting to modern transport methods will be seen in the near future.

Southern Railway Shows the Way

Curiously enough, the much maligned Southern Railway has shown the way. The loud-speakers installed at London Bridge station for announcing the departure of trains have been a great success, although there have been a few complaints from passengers who waited for some hours for a train to Herne Hill owing to the announcer, who had been borrowed from the B.B.C. for the occasion, committing the unfortunate solecism of sounding the initial aitches.

This idea could easily be adapted to the task of speeding the departing friend, the announcer interpolating his directions about trains with the conventional remarks and sounds normally uttered by the seer-off.

The person being seen off might, perhaps, consider that the remarks of the loud-speaker occasionally lacked continuity of bearing, but nobody could claim that the normal conversation in such circumstances is a model of connected thought. Something on these lines would do quite well :

"Number 4 Platform, stopping train to Aywudseath."

"Well, dear, let's know how you get on. You'll be sure to drop a line as soon as you get there, dear, won't you?"

"Passengers to Brighton and Worthing. Your next train is the 5.15 from Number 10."

"Well, good-bye, dear, good-bye . . . Oh! I don't think you're going after all. Give my love to them all, won't you?"

"Plenty of room in the front of the Dover train-!"

"Are you sure you've got your ticket safely? I do hope you won't have any trouble with the luggage, but I think you'll be all right. He seemed such a nice young man, didn't he, dear?"

"Number 7, all stations to Crystal Palace."

"Well, good-bye, dear, don't forget to let me know how you get on . . . I thought you were really going that time——"

It will be possible to effect considerable staff economies by substituting loud-speakers for the clerks employed in inquiry offices during the holiday season. The personal touch will be sacrificed, but, on the other hand, even if an inquirer does not obtain the time of the particular train in which he is interested, he will secure a mine of information about the whole system which may prove invaluable on some future occasion.

Unruffled Recital

And, however large the crowd, however absurd the points on which they seek enlightenment, the announcer, detached and remote in the calm and peace of the studio, will be able to proceed with his recital unruffled. The following gives some idea of the form the announcement will take, and shows the wide range covered :

"The 10.15 excursion to Margate is being run in three sections. Dogs, Birds, Reptiles, or other animals may not be taken into the carriage without permission of the guard. Owing to coastal fog at Hastings, the 9.25 from Blackheath, due in at 10.5, will be 20 minutes late. For Nether Wollop, proceed via Maidstone, Crowborough, Hawyards Heath, and Wallop Magna. The capital 'A' against the 11.30 to Roberts Bridge in the time-table means that it stops to pick up passengers at Little Woneyed on the first and third Tuesdays in February and June. Children under 3 years of age are carried free; in case of doubt the Company is entitled to demand the production of a birth-certificate. *Il est défendu de se pencher au dehors de la fênetre.* The 11.25 for Herne Bay will, as far as we know at present, start from Platform 12 at 12.40. There is no by-law against eating oranges in the compartment, but the practice is not encouraged."

Special Programmes!

Already a number of trains are fitted with receiving sets, and it is only a matter of time before all long-distance trains have loud-speakers as a matter of course. The ordinary programmes will not, however, be quite suitable to the conditions of mind which a railway journey engenders, and to overcome this difficulty arrangements are being made for special railway programmes to be broadcast on a separate wave-length. A typical railway programme would be as follows :

1.30. Dance music from Clapham Junction by the Animated Milk Churns.

N.B.—Cotton-wool can be obtained from the dining car attendant for passengers with sensitive ear-drums.

2.0. Topical chat by Professor Humdrum of the Royal Statistical Society on "Facts and Figures about Fatal Railway Accidents."

2.15. Address by the General Manager of the Southern and Northern Insurance Company on: "Will you leave your widow well-off?"

N.B.—Special accident insurance policies can be obtained from the dining-car attendant at sale prices.

2.45. Musical Monologue by Driver W. Adams. "How I saved the 12.69."

3.0. Scientific talk by Professor Rocke on "The Geological Characteristics of the Buffet Bun."

3.30. Song cycle by Mr. F. Flagge: "A-Shunting We Will Go," "I Let Down Your Window," "Wayfarer's Night Song."

3.45. Tone Picture from the Stratford Engine Shops.

4.0. Closing prices of Season Tickets and Cheap Day Tickets broadcast from the Railway Clearing House.

4.10. Art Talks—Mr. A. Canvas, A.R.A., on "The Aesthetic Appeal of the Station Waiting Room."

4.30. Practical Psychology. Talk by Professor Froude: "The Mental Reaction of a London Porter to a Twopenny Tip." IRVINE FOSTER.

Wireless for Women

THE former Artistic Director of the B.B.C., Mr. A. Corbett-Smith, recently confessed that in the course of his duties at Savoy Hill "wireless for women" was something that was rather taken for granted.

Some listeners may remember that in the early days of broadcasting special "Women's hours" were included in the programmes of London and one or two of the other larger stations. These "hours" did very little more than become the subject for much fun-pointing by mere males (who also laughed at the Children's hour and the "Uncles" and "Aunts") and in consequence were soon discontinued.

Little of Feminine Interest

Almost every woman who has the time to listen to her husband's set during the day will vouch for the fact that not very much with a feminine interest is "put on the air." The B.B.C in fact, have given up catering for the ladies as a hopeless job.

And why? I was discussing the subject recently with an influential Fleet Street man. Most of the "dailies" contain a woman's page, or at least, a daily feature of feminine interest, and I thought there might be some example set by the newspapers which the B.B.C. could follow.

My Fleet Street friend merely pointed out what anyone who reads his paper could doubtless observe for himself, namely, that present-day "women's" pages are interesting equally to men and women. The woman is not quite the peculiar creature that some men believe her to be!

If newspaper women's pages were confined solely to cookery hints, as were the broadcast women's hours, both male and female readers would long ago have clamoured for the feature to be discontinued.

The interests of a modern woman are identical to those of her menfolk, and she wants her broadcast information given in a masculine, direct manner. She does not want to hear "namby-pamby" tit-bits, or, solely, a broadcast version of Mrs. Beeton!

Women's Wide Interests

Fashion, sport of all kinds, motoring, politics, business and domestic efficiency all come within a modern housewife's sphere of understanding. She is quite willing to accept her wireless set as an educator as well as a music maker.

And when the B.B.C. more exactly comprehends and supplies her requirements, she will take more interest in valves, transformers, and the whole gamut of radio technicalities.

QUEUE.

A Wireless Phantasy

I WENT downstairs the other night
Because I thought I heard a sound;
Yes, from my study gleamed a light,
No doubt a burglar was around!
I entered quickly, though I trembled—
And found my wireless set assembled.

Two Valves were singing a duet,
An Amplifier joining in.
Some Dull Emitters seemed upset,
But all the Coils enjoyed the din.
"I think," said an Accumulator,
"I'll have some oxygen—hi! waiter!"

At this a young Electrode went
To bring supplies as he was bid,
The while an outsize Filament
Made conversation with a Grid:
An Anode seemed inclined to hector
A shy, though capable Detector.

An Earphone and Transmitter held
A very spirited debate:
"Withdraw!" an angry Wavelength yelled,
And then began to oscillate,
And through it all a Beam kept beaming—
Then I awoke, I had been dreaming!

LESLIE M. OYLER.

Counterpoise Fallacies

WHEN, owing to the position of a set, it is quite impossible to obtain an earth which is short and direct, and therefore efficient, a counterpoise earth can generally be looked upon as a way out of the difficulty.

For the benefit of those who do not know what a counterpoise is, it may be explained that an earth of this description consists of a number of wires forming a subsidiary "aerial." The wires are as carefully insulated from earth as is the aerial itself, and the lead from the counterpoise to the set must be as short as the aerial lead-in.

Popular Misconceptions

There are one or two popular misconceptions in regard to counterpoise earths. First, it is sometimes thought that the wires should be as close to the ground as possible. Second, that the counterpoise should be an exact replica of the aerial in regard to wire length and spacing.

Both these conditions are inadvisable. There is no need to make the counterpoise a duplicate of the aerial. All that is necessary is that it should be an effective screen between the earth and the aerial. The distance from the counterpoise wires to the ground is relatively unimportant. B. I. M.

Specially Written for the "W.M." by B.B.C. Officials

How We Shall Arrange Controversial Broadcasts

IN the archives of the B.B.C. are enshrined a vast mass of extracts from the national newspapers and periodicals. So detailed is the system of filing that it is possible to trace at short notice any reference, however trivial, to anything that has been written about wireless and, in particular, broadcasting. Among this multitude of press cuttings are thousands—most of them consisting of speculation—devoted to the question of the transmission of controversial matter. It is no exaggeration to state that this subject has, in fact, occupied more space in the Press than any other single aspect of broadcasting. This is easily proved by mere bulk alone.

Interesting Aspects

A study of these cuttings reveals, however, some interesting and amusing aspects of the controversy about controversy. The outstanding fact is that the Post Office and the B.B.C. have each in turn been blamed for the fact that any restrictive measures at all existed, and critics who at one moment were severe in their condemnation of the B.B.C. eventually decided that they were barking up the wrong tree and turned their attention to the other alleged culprit.

Personal Grudges

Much of the criticism has emanated from people who at one time or other thought that they had a personal grudge against the authorities in this matter, and gave vent to expressions of opinion which, while they might have been witty, were not wise, and were no recommendation as regards the treatment of a controversial topic with which they might have been entrusted to deal if the ban had not existed.

Long before any discussion took place in the Press as to the desirability of treating controversial topics via the microphone, the B.B.C. had expressed its official view on the subject, and had suggested that the progress of broadcasting would be impeded or nullified so long as freedom of action was withheld. In point of fact, nearly three years ago the B.B.C. defined a policy which stands in small need of revision with the effluxion of time. It said that if debates could be arranged regularly on controversial topics and if leaders of opinion were given the opportunity of placing their case before the public, a great service would be rendered; but there was this reservation, namely, safeguards for impartiality would be necessary as well as discrimination in the choice of subjects.

The B.B.C. realised that in developing the broadcast service it was forging an instrument which would enable the public to take a keener interest in affairs and would enable them after a time to make up their minds on vital matters without regard for the dictated and partial opinions of others. The old broadcasting company was fully alive to the possibility that, with complete freedom in the choice of subjects for the microphone, a danger to be guarded against was that which the apostles of strife might create. This would be quite a different matter from a reasonable effort to assist the spread of knowledge with reasoned arguments.

Policy Strengthened

The Corporation strengthened the old Company's expression of broadcasting policy by stating publicly, some time ago, that the admission of controversial matter into the ordinary programmes was being tried out by small gradual steps. Everyone concerned was agreed that the complete exclusion of debatable subjects could not continue and that the presentation of sober and broad-minded views on all sides of a controversy would do good. There were some differences of opinion, however, as to what constituted controversy and, in fact, one distinguished public man declared that if and when he broadcast, he would give no pledge to avoid touching on controversial topics unless the Postmaster-General would first define what was meant by "controversy." Some listeners expressed the opinion that unless any controversial matter broadcast was solely for their amusement and definitely not for their instruction they would be opposed to the lifting of the ban.

Other Demands

Other listeners said that, as wireless enthusiasts pure and simple, they did not, for example, desire the broadcasting of speeches in the House of Commons. The Postmaster-General voiced the view held by most serious-minded people when he said

RADIO IS GOOD OUT OF DOORS!

See how these enthusiasts are enjoying themselves. You can do the same if you build the Sunshine Five. (*See page 294.*)

that if politics were once let into broadcasting, it would be impossible to keep broadcasting out of politics.

A question which was asked many times prior to the Prime Minister's statement in the House of Commons on March 5, when he announced the freedom to be conferred on the B.B.C., was "Who is really responsible for the existence of the restrictive measures?" The situation was explained as long ago as November, 1926, by the Postmaster-General, who stated that the Government maintained the restriction upon the broadcast, by speech or lecture, of matter dealing with political, religious, or industrial controversy.

The Government's Object

The object which the Government were anxious to achieve was the provoking of discussion and criticism of their decision, because their view was that the matter had received quite imperfect consideration at the hands of the public in general and had not received a very great deal of consideration in the House of Commons. By ventilation of the subject the Government would be in a position to take note of the trend of public opinion.

The responsibility for the ban then appears to have rested with the public themselves, through their apathy; and it was only when some indication was given that the introduction of controversy would be welcomed by the public that the Government decided to allow greater latitude to the B.B.C.

Now, having been let into the inner history of the steps which led up to Mr. Baldwin's announcement of March 5, let us see how the B.B.C. proposes to avail itself of this new-found freedom. The latitude applies to "religious, industrial and political topics."

In the Religious Field

Certain sections of the religious community would like to see an occasional incursion into the religious field, when master minds might be pitted against each other on some very vital topic, such as Prayer Book revision, or on some aspect of religious feeling where a real test could be applied to the country's interest in religion. It may, however, be stated at once that there will be no change in the established policy and procedure of the Corporation. Subjects that are likely to offend religious or moral susceptibilities will not be discussed for broadcasting. The careful consideration which has been given of the many issues involved has decided the B.B.C. to proceed by means of cautious experiment with the development of the new programme material made available by the removal of restrictions. The first and most important point that will be borne in mind is the wide and varied character of the broadcasting constituency and also the fact that broadcasting is under unified control. Having come to an early and definite decision on the question of religious controversy, the Corporation will next consider the manner in which political and economic controversial matter should be handled and it will, no doubt, be decided that only on definitely prescribed occasions and subject to adequate safeguards as to impartiality and equality of opportunity shall controversial matter be included in the programmes.

"Controversial occasions" will be labelled as such, and will in the meantime take the form of debates and discussions. It is difficult to define precisely the occasions on which controversy might be regarded as permissible; but one might speculate that the subjects which would be considered suitable for the microphone are the following:—

"Should wages be paid according to the needs of the wage-earner, or according to the value of his work?"

"The return to the gold standard and its effects on national prosperity."

"Is a minimum wage desirable or practicable?"

"Is the Surtax fair or workable?"

TO SPEAK FROM 5WA

The Rev. E. Ebrard Rees, a contributor to the "Wireless Magazine," who is an authority on John Bunyan, will speak on Bunyan from Cardiff on May 1

Outside Broadcasts

There are controversial elements in outside broadcasts, adult education, talks in general and so forth; but the existing policy in relation to these matters, namely, of gradual and experimental extension, will be continued and developed. Finally, a point which the B.B.C. must emphasise is that freedom to deal with controversial subjects does not affect the responsibility of the Corporation of continuing in the bulk of its work to adhere to a non-partisan attitude in presentation.

CLAPHAM—AND NOT DWYER

HOW many listeners know that the B.B.C. carry out much laboratory test work in Clapham? Yet for many months a house in that locality has been the scene of experiments conducted by Capt. West and his staff.

The laboratory is not, primarily, a receiving station, and the work carried on there is chiefly of a "studio" nature. Various acoustic problems have been solved in this department, and new microphones and similar equipment have been put through their paces by the Clapham experimenters. B. B.

AN IDEA FOR THE POST OFFICE

OUR own postal authorities might take a hint from their colleagues in Ceylon and use as a stamp-cancellation mark some slogan that encourages broadcast listening. A slogan now in use in Ceylon is: "Are you a broadcast listener?", followed by the cost of a licence.

All You Want to Know About Moving-coil Loud-speakers Next Month

Even the Non-technical Listener Will Be Interested in the Question:

Is There Eternity in the Ether?

ARE our wireless concerts immortal? Much interest has been aroused by statements in the daily Press to the effect that wireless waves never die out. And that if our grand-children have ultra-sensitive wireless receivers they will be able to hear all over again the present-day broadcast concerts, talks and Oxford accents.

Ether Waves Everlasting

The question depends upon the now fairly general assumption that ether waves of the light and wireless variety are everlasting. Or, at least, will persist for hundreds, thousands, and even millions of years. As a matter of fact, we have actually seen and caught, as it were, light waves which have been travelling through space for over a million years. And wireless waves belong to the same ethereal family as light waves, and in many respects are identical. Thus their immortality is also likely.

It follows then, that not only are our wireless concerts probably everlasting, but pictures of all things upon which light has shone from the beginning of time are immortal too.

Somewhere in the ether of space real definite pictures of the world are travelling on and on like the unwinding of an endless cinema film. There is a picture of the beginning of the earth—a nebula. The hardening of the outer crust—the vegetation appearing, with lower forms of life.

Time passes—man appears, and at length, on the unwinding film comes civilisation. Egypt, Babylon, rise and fall, likewise Greece and Rome, right down the ages to our own. And with the pictures of our own civilisation comes something new, accompanying the light waves from the earth. Man has discovered wireless—and is pouring wireless vibrations into the ether for the first time. Probably Nature smiles, like a fond parent at the precocity of its child.

Position of First Broadcast Concert

What is more, it is fairly simple to work out whereabouts in space the first broadcast concert is at the moment, the whereabouts of Cleopatra's first meeting with Anthony, or the King opening Wembley Exhibition, or the burial of Mr. Smith's grandfather, who lived at Peckham. So blue bloods beware of any bogus ancestors, for somewhere out in

SOME RECENT BROADCASTERS

(Left). Alan Johnstone, Scotch tenor

(Below). Margaret Halstan, actress

(Left). Frank Cantell

(Right). John Booth, singer

(Below). Norman Archer

space are the ghostly pictures of your ancestors, much more faithfully reproduced than in the ancestral gallery!

Near Alpha Centauri

If we assume that the first broadcast concert took place four years ago, that concert is at the moment in the vicinity of our nearest fixed star, Alpha Centauri. The calculation is simple. Alpha Centauri is four light-years distance from the earth. A light-year is the distance a given ray of light will travel in one year, and wireless waves travel at the same speed as light, namely 186,000 miles per second. So that in four years the wireless waves of our first concert will have travelled four light-years in distance. Of course, this is presuming that wireless waves go outward and onwards in all directions.

To go a little further—twenty-five thousand years will have passed before that concert will have reached even the near frontiers of the Milky Way which we see in the sky so clearly on some nights. (What will have happened to our earthly broadcasting when our first concert reaches that distant clime?)

Twenty-five thousand years ago Cro-Magnons inhabited this country together with tigers and mammoths. If there are beings on the planets of the Milky Way looking at our solar system through a super powerful telescope, they will not see the world as it is to-day, but as it was twenty-five thousand years ago. Possibly they will be saying to each other about us:

"Well—there isn't much sign of intelligence on that world yet . . . wonder when it's coming, conditions pretty favourable. No sound of wireless music up to the present."

Travelling for a Million Years

It has been mentioned that we have seen light-waves which have been travelling through space for over a million years—constantly maintaining their terrific speed of 186,000 miles per second. This is in the great telescope at the Mount Wilson Observatory. In this telescope it is possible to see a tiny star which is over a million light-years distant from us. A million years ago that light image of the star which the astronomer sees to-night—left the actual star and is still very much alive and kicking. Truly light-waves are eternal, so why not wireless waves?

When it comes to our grandchildren hearing our broadcast concerts over again, however, we are on less sure ground. For, although wireless waves certainly cling to the earth, up to a point, these waves tend to become absorbed and it is only those waves which gain the freedom of outer space which can persist.

Thus the wireless concert which is here to-day is gone to-morrow, flying on its way through space. But it may—and here is the point—it may return to the earth from space because we now know that it will describe a great circle with a possibility of returning to its source, like a bad penny.

The time which a light or wireless ray will take to return to its source has been worked out by some of our great mathematicians, and it is not in the time of our grandchildren, but some untold millions of years hence, in fact.

There are a few other snags, too. The whole solar system is moving rapidly through the Universe. Possibly every day we occupy some entirely new position in space—and this also complicates matters for any of our grandchildren with eaves-dropping tendencies. Thus an instrument to detect these early broadcast concerts of ours will be of little use for some millions of years to come. (But, after all, we are merely on the fringe, and how little is a million years to the earth and its development.)

Light Images or Pictures

With regard to light images or pictures—it is a different matter. Even at the moment pictures of a younger earth may be floating past your back door. The solar system may be floating through a picture of the earth in the throes of the Ice Age or some other ethereal image of another world—had we but the means to see it all.

There is also a school of scientific thought which believes, with a certain amount of justification, that every thought we think creates ether vibrations. They base their assumption on the mechanistic theory of the mind, which says that a thought is merely the rearrangement of the molecules of the brain. And we know that if these molecules are disturbed they create an electro-magnetic strain in the ether similar to the electro-magnetic strain we set up with a broadcasting transmitter.

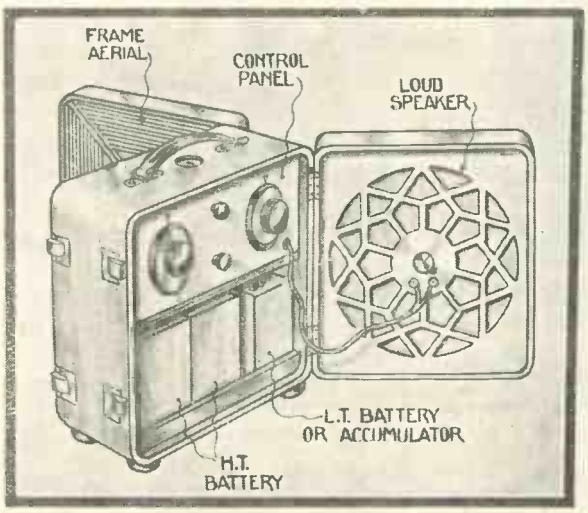
So we are to believe—and it is quite likely—that in addition to eternal wireless concerts, and light pictures of the past, all our thoughts which we deem so private are also immortal—the common property of the ether, may be for future use. Telepathy is accounted for in this way.

Preposterous as it may sound, it is nevertheless quite possible that the thoughts of our famous dead (and the others) may yet be known to posterity.

Startled by a New Invention?

Probably in some future time, the then ultra-civilised world will be startled by a great new invention—just as we were startled by wireless . . . thus: "Take notice. A new instrument for revealing the ethereal images and voices of the past, and laying bare the thoughts of the Ancients of the 20th Century and other remote times. Price complete . . ."

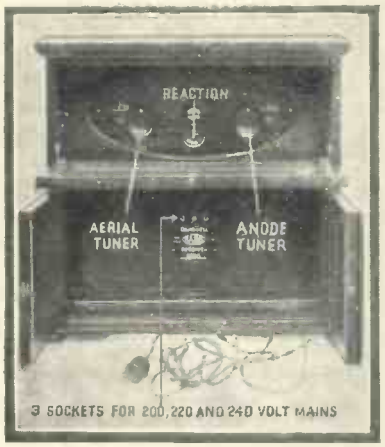
A PORTABLE SET SUGGESTION



Here is a suggestion that home constructors can work up individually to suit their own special requirements

All Tests Are Conducted Personally by Our Technical Editor at the Furzehill Laboratories

New Sets and Apparatus Tested



Front View of Gambrell Mains Receiver

GAMBRELL MAINS RECEIVER

GAMBRELL'S have specialised for some time in the production of receivers intended to be run entirely from electric-light mains. This is a proposition which, in general, is fairly simple, but is apt to be troublesome in particular. It is no uncommon thing to find a receiver which works perfectly on five or six different supply circuits, but which will refuse to give satisfaction on the seventh.

In the case of a firm which has specialised in receivers for this particular purpose, one may reasonably expect little difficulty, and in the case in question the results obtained were excellent. The model was an A.C. model, the current being converted to D.C. at 200 volts. A metal rectifier is used capable of passing 100 milliamperes at this voltage and the output from this rectifier is smoothed with a double-choke and condenser filter.

Inside the Receiver

All these features can be seen in the photograph of the eliminator portion of the receiver. This portion, incidentally, is normally completely boxed in and is not accessible to the ordinary user since no difficulty is likely to arise with this portion of the equipment, owing to the absence of valves or similar devices.

The receiver proper employs one H.F. stage, a detector and one L.F. stage. The filaments of the valves are run in series and as Mullard .1-ampere valves are used, this current can be supplied from the 200-volt system already referred to by inserting a suitable resistance in series. The voltage drop on this resistance serves to supply the high tension for the various valves.

A centre-tapped tuned-anode circuit is employed for the high-frequency stage, a centre-tapped coil being used in the first circuit. Such an arrangement gives quite a selective system and the results were very pleasing. The neutralising condenser, which is a Gambrell Neutrovernia, is utilised for reaction purposes.

Geared slow-motion dials serve to make the tuning easy and not too critical and this, coupled with the entire absence of hum, makes the receiver an attractive proposition. A similar receiver is available for use on D.C., the mechanism being similar with the exception that the rectifying apparatus is omitted.

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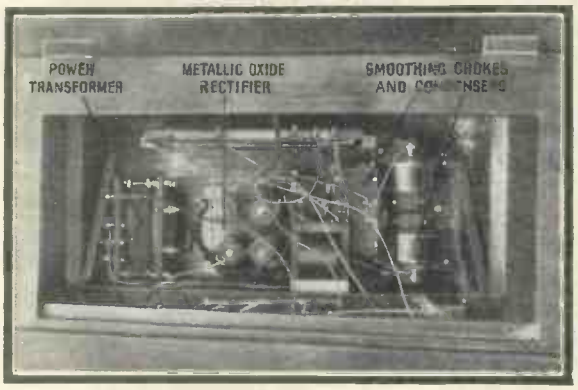


Inside Arrangement of the Gambrell Mains Receiver

BRANDESET NO. 3A

THIS popular three-valve receiver is an excellent example of the cheap set. It is essentially a factory-built job, the assembly being laid out on mass-production lines as opposed to a mere collection of ordinary components.

A single tuning condenser is utilised, this being provided with a thumb control having two drums, one giving a quick motion and the other a fine adjustment. This is placed centrally on the panel, the left-hand side being occupied with a reaction control and a simple range switch, while on the right-hand side we have the on-off switch which has three positions. The first of these is the off position; the second gives an arrangement with two valves only, acting as a detector and one L.F.; while the third position brings all three valves into operation.

Elliptical Cone Loud-speaker

All these controls can be seen from the photograph accompanying this report, as also is the Ellipticon, which, as the name implies, is an elliptical cone loud-speaker, which gives very pleasing results.

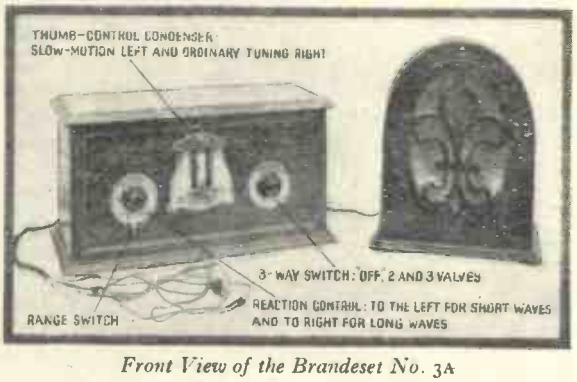
The interior view of the receiver is of interest owing to the method of construction adopted. The three valve holders are carried on an insulated strip which is floated at each end on rubber bands. This obviates the necessity of providing vibratory valve sockets. The two tuning coils can be seen on the left-hand side of the panel, the short-wave coil being a simple solenoid and the long-wave coil being a duolateral coil.

The reaction coil swings in between the two, coupling to either one of the other as required. As will be seen, transformer-coupled L.F. stages are employed, the circuit being a straightforward detector with two L.F. stages.

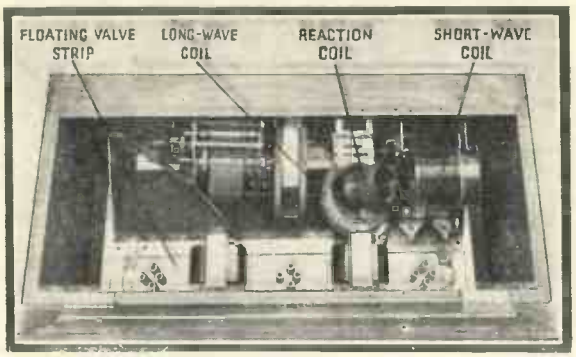
Good Performance on Test

The performance of the set was good, ample signal strength being obtainable with reasonable selectivity. No difficulty was experienced in tuning in a number of distant stations while London was transmitting. Three aerial terminals are provided so that the required order of selectivity can be adjusted to local conditions.

A particular feature is that the wooden front panel of the receiver is metal lined at the back so that hand-effects are noticeable by their absence and the



Front View of the Brandeset No. 3A



Internal Arrangement of the Brandeset No. 3A

receiver is generally simple and easy to control. A fully illustrated instruction book obviates any trouble in the hands of the novice and serves to complete a well-thought out production.

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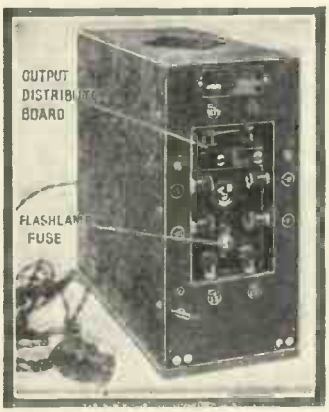
COSMOS ELIMINATORS

THE design of a mains unit capable of being used with any set is still a matter of extreme difficulty owing to the varying conditions which are encountered in practice. The difficulty of "motor boating" is perhaps the most serious factor to be contended with. This is overcome in the Cosmos eliminator by the provision of a separate tap for the last valve.

The loud-speaker return is not taken back to the L.S.+ terminal on the set, but is connected direct to a special terminal on the eliminator. The H.T. to the remaining valves in the receiver is taken from a separate tapping which



Front of the Cosmos H.T. Eliminator

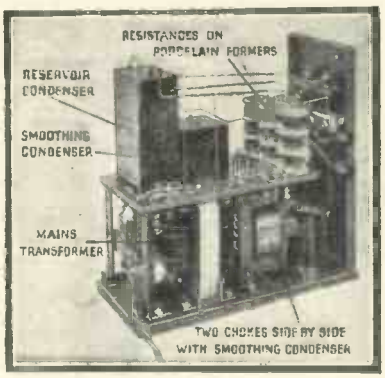
is fed through a separate choke and smoothing circuit.

Up to 20 volts grid bias is provided in 5-volt steps, but since this is run off a separate filter system, this grid bias can only be used for the last valve. An ordinary grid-bias battery must be used for the earlier stages of the receiver, but such stages do not require more than a 9-volt battery, so that this is quite an easy matter to provide.

The input to the eliminator is introduced at the back where there is a distributor board containing a plug and a number of sockets, numbered from 200 to 250 in steps of ten. The plug is inserted in the socket corresponding to the supply voltage.

On the front of the eliminator, there are two further distributor boards one of which has 200 and 240 volts available for the high voltage (last stage) tapping, while the other gives 40, 80, 120, or 160 for the normal H.T. tap to the receiver. A switch and a flash-lamp fuse complete the assembly on this panel.

At the top are two terminals which are normally kept short-circuited, but which



Internal View of the Cosmos H.T. Eliminator

may be used for choke feed on the last stage. If this connection is desired, the L.S.+ terminal on the eliminator is taken direct to the anode of the last valve and the loud-speaker is inserted in between these two terminals at the top of the unit, these terminals being normally strapped together.

At the back of the instrument is a socket into which the adaptor from the L.T. eliminator, if any, may be plugged. This latter unit is a simple step-down transformer for supplying the voltages on Cosmos A.C. valves. By this means, all voltages can be supplied from the mains. Plugging the L.T. eliminator into the back of the H.T. unit in this manner brings all the voltages under the control of the single switch on the front of the main eliminator.

Exceedingly Well Constructed

The instruments are exceedingly well-constructed and are housed in metal cases completed in a black crystalline finish.

A particular feature which we were very pleased to see was the provision of definite air gaps in the smoothing chokes. This is deliberately done to avoid saturation effects and is an indication of the thoroughly up-to-date design of the instruments.

Both units gave excellent results on test and should prove of considerable value. Complete and detailed instructions are supplied with each instrument in the form of a small booklet.

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FORMO COLLAPSIBLE SCREEN

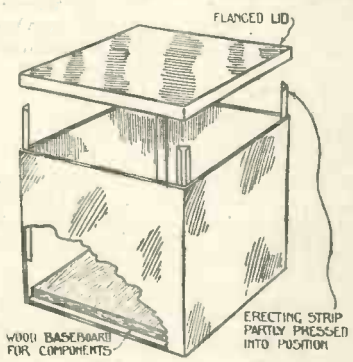
THERE are many cases in which the use of a completely screened circuit is desirable. In such cases the building up of the screening box is a matter of some little difficulty, since trimming and preparing sheet metal, although comparatively simple, is apt to produce clumsy and unsightly results unless very great care is taken. A machine-made product is clearly capable of producing neater results than the average hand-made box.

To meet this need, the Formo Company have produced a collapsible screening box. This is made with the sides,

J. H. Reyner, B.Sc., A.M.I.E.E., Technical Editor, checking over test reports in the Furzehill laboratories

New Sets and Apparatus Tested *(Continued)*

top and bottom in the form of flanges. The ends of the sheet are curled round and by the use of corner pieces a complete box can be assembled in a very short time. The pieces are fixed together by sliding one into the other, no bolting being necessary, while in addition holes are cut in the sides at suitable places for mounting condensers



Formo Collapsible Screening Box

or leading wire through into the box itself.

The whole instrument forms a very neat job when completed, and can be recommended for use. It is made by the Formo Company, of Cricklewood Lane, N.W.2.

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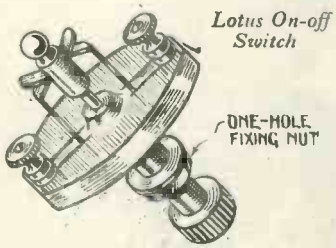
LOTUS SWITCH

AN on-off switch connected in the battery circuit is an essential part of any valve receiver. This switch may, with advantage, be of the push-pull variety, since this type is inexpensive and simple to operate, and if correctly designed is not liable to give trouble after long usage.

A neat form of push-pull switch has been submitted for test by makers of the well-known Lotus components. This component comprises a metal plunger with an insulated knob at one end. Two metal springs mounted at each end of an



Lotus On-off Switch

insulated support bear on the plunger, which is protected by an insulated sleeve in the "off" position.

Owing to the powerful nature of the contact springs, a good electrical contact is always ensured in the "on" position: whilst due to the smooth surface on the insulated bush and suitable contour on the metal end, the action of the switch is smooth, and the "on" and "off" positions are definite. A terminal is mounted on the insulated support connected to each spring. The switch may be fixed to the panel by drilling a single hole.

Lotus components are made by Garnett, Whiteley & Co., Ltd., of Broadgreen Road, Liverpool.

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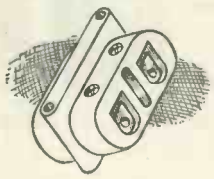
ATHOL CONNECTOR

IT is often desirable to connect two pairs of leads together and at the same time keep the two connections so formed apart. For example, it may be desired to lengthen a lead from the electric-light mains, in which case it is often necessary to bind the exposed surfaces with insulated tape or some such medium.

Connections of this type may be made with ease and without risk of short-circuiting if a suitable connector is employed. The Athol Company, of Manchester, make an attractive connector, which consists of two brass sleeves housed in a neat but substantial porcelain holder. The leads to be connected are inserted in either side of



Athol Connector

the sleeve and locked by small but accessible screws.

In this manner, excellent connections can be made and, since the metal sleeves are sunk below the porcelain surface, there is little risk of accidental short-circuit. Two holes are provided in the porcelain holder for fixing to the base-board if desired.

The address of the manufacturers is the Athol Electrical Co., of Tyson Street, Cheetham Hill, Manchester.

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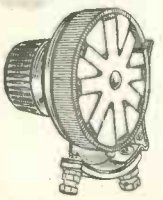
IGRANIC RHEOSTAT

THE use of rheostats is coming into favour once again, the tendency being to employ a master rheostat on the receiver instead of a switch. For a purpose such as this an expensive item is not required, but at the same time one experiences pleasure in handling a smooth control which is neither mechanically or electrically harsh.

The new Igranic rheostat which we have received for test has both these desirable characteristics. It incorporates the principle adopted on the older form of Igranic resistance in which a contact rubs on the outer surface of a drum carrying the resistance element, and not on the edge as has become very common. An excellent contact with a smooth action is thus obtained.

The instrument in question is small in size and can easily be mounted, while it is provided with an attractive knob and pointer. It should prove of interest to readers. The sample submitted



Igranic Filament Rheostat

for test was rated at 15 ohms. and was actually found to have a maximum resistance of 16 ohms, giving an ample factor of safety.

The manufacturers are the Igranic Electric Co., Ltd., of 149 Queen Victoria Street, E.C.4.

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PIRTOID FORMER

THE fact that losses are set up in ebonite tubes has been recognised by constructors for a considerable period and various other dielectrics have been employed from time to time.

One of the best-known of these is Pirtoid, this being a form of varnished paper compound which has excellent insulation and low dielectric loss. It has hitherto been produced in the natural finish which is a light yellow, but H. Clarke & Co. have recently produced a black finished model which is similar in its electrical properties to the original form.

The material is light and formers constructed of it are rigid and easily worked. They can be highly recommended for use in winding coils of any type.

Pirtoid is made by H. Clarke & Co. (M/c.), Ltd., of Eastnor Street, Old Trafford, Manchester.

New Black-finish Pirtoid Tube

◆ ◆ ◆

COSMOS A.N.P. COILS

ONE of the most efficient high-frequency circuits is the tuned anode provided with a centre- or quarter-

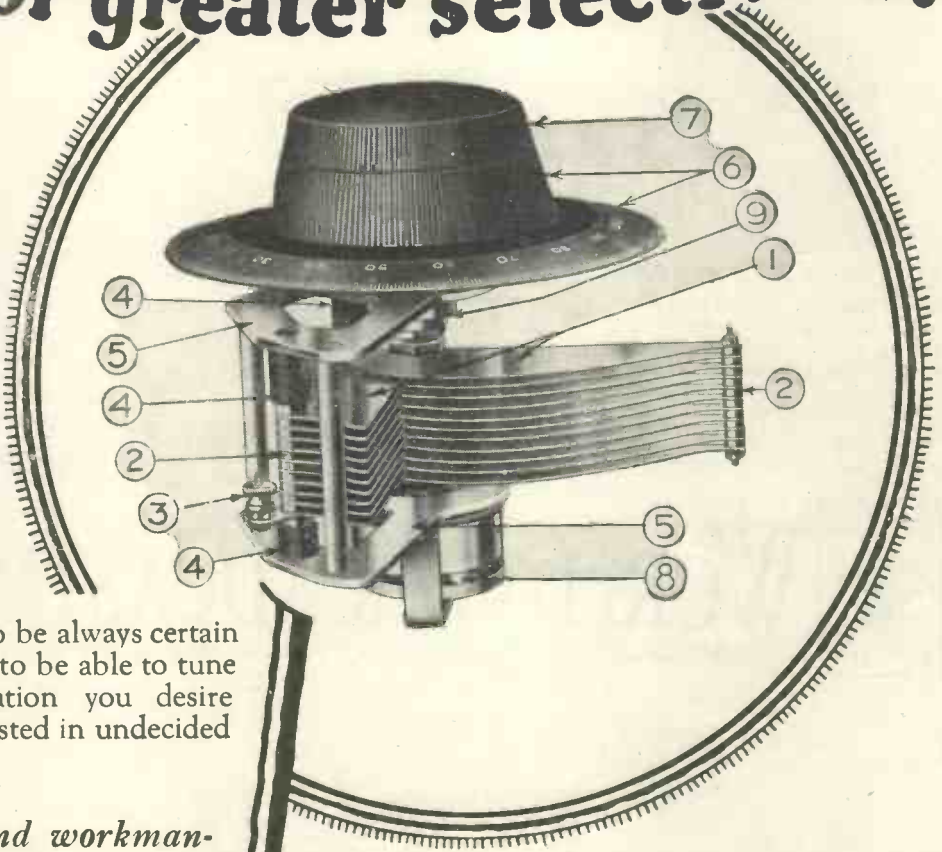
(Continued on page 370)

For Further Particulars Write to the Manufacturers!

KILOCYCLE TUNING for greater selectivity!

12/-

Complete with Knob and Dial and Vernier



How delightful to be always certain of your station—to be able to tune in whatever station you desire with no time wasted in undecided searching.

In design and workmanship, the Dubilier K.C. Condenser maintains the recognised standard of Dubilier efficiency and, like all Dubilier products, is unsurpassed in performance. Used in conjunction with the Dubilier Toroids it will give uniform kilocycle tuning.

WHAT YOU GET FOR YOUR MONEY

1. *VANES* of stout brass sheet. 2. *SPACERS*, between which vanes are firmly clamped, ensuring rigidity and eliminating possible resistance through loose connections. Consistent spacing assured by the extreme accuracy to which spacers are turned. 3. *TERMINALS*—one giving direct connection with the frame and rotary vanes and the other with the fixed vanes. 4. *INSULATORS* of high quality moulding material under compression, forming an effective insulation of the stator plates, and eliminating dielectric losses. 5. *END PLATES* of the skeleton type, ensuring rigidity and lightness. 6. *KNOB AND DIAL* of finest finish and engraved in 100 single degrees. Diameter 4 in. Main knob rotates moving vanes direct. 7. *SMALL KNOB*. This moves independently of the main knob and works a slow-motion drive. 8. *SLOW-MOTION BALL DRIVE*. Approximate reduction ratio of 200-1 enabling precise tuning adjustments to be easily secured. 9. *BALL RACE*, giving a velvet-smooth movement whether the direct or slow-motion drive is used, and with entire absence of backlash in either case. One hole fixing—¼ in. clearance. A large nut is provided for mounting on panel. Maximum Capacity ·0005.

DUBILIER

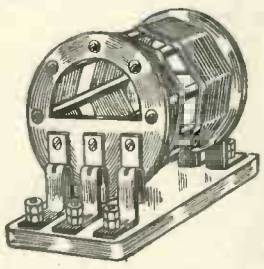
M139

Advt. of the Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, W.3.

Mention of the "Wireless Magazine" will ensure prompt attention.

New Sets and Apparatus Tested *(Contd.)*

tap. The tapping serves not only to minimise the valve damping, but to enable bridge neutralisation arrangements to be adopted. Unfortunately, difficulties arise with this method owing to parasitic oscillations, which are produced by one half of the coil resonating at its natural frequency, and rather



Cosmos A.N.P. Coil

involved methods have to be adopted to combat this trouble.

An ingenious system has been employed by the Cosmos people in their A.N.P. coils. At the parasitic frequency, the currents in the two halves of the coil are in opposition to each other, whereas at the true frequency the currents are in the same direction at any instant. Two small anti-parasitic windings are coupled to the coil, one to each half, and are so arranged that the parasitic oscillations induce voltages in these anti-parasitic windings in the same direction and the system acts as a short-circuited secondary.

At the normal frequency, however, since the currents in the two halves of the coil are in the same direction, the voltages induced in the two sections of the anti-parasitic winding are in opposition and no absorption takes place. The idea is extremely ingenious and tests made in our laboratories indicate that the remedy was effective.

"Astatic Non-parasitic"

The name A.N.P. stands for "astatic, non-parasitic," which implies that the coil is astatically wound. This is obtained by winding the two main sections of the coil in opposite hand, and these astatic properties are valuable in avoiding coupling between neighbouring circuits. The inductance is only made in one type, having tappings quarter, half, and three-quarters of the distance along.

The coils fit a special holder provided with six-spring contact strips, three at each end.

Cosmos coils are made by Metro-Vick Supplies, Ltd., of 155 Charing Cross Road, W.C.2.

Are You Building The Music Charmer?

UNDOUBTEDLY one of the most popular three-valve designs published by any radio periodical, the Music Charmer (WIRELESS MAGAZINE, *March*, 1928) *is giving pleasure to thousands of listeners all over the country. Anybody who is hesitating about building this fine set, should note this letter from a reader at Chalfont St. Giles:*

I have made, I suppose, some dozens of super sets with varying degrees of success, but was recently requested to make the "cheapest possible" three-valve set and the Music Charmer struck me as being eminently suitable.

Wherefore, I hied me to my box of spare parts and with the addition of some of the cheapest material on the market I made the set, exactly as specified, except that I soldered all joints.

But, on testing the set, I found that the cheap loud-speaker I had bought for it was wholly inadequate for the terrific volume it had to deal with—even German stations sounded like half-a-dozen jazz bands in the same room.

As a result my five-valve portable is destined to be rent in small pieces to make the Music Charmer—the best three-valve set I have made.

(*Blueprint No. W.M. 60 post free for 1s.*)

Wave-length in Metres	Station	Call Sign	Wave-length in Metres	Station	Call Sign	Wave-length in Metres	Station	Call Sign	Wave-length in Metres	Station	Call Sign
24	Chelmsford	5SW		Innsbruck	—	379.7	Stuttgart	—	545.6	Sundsvall	—
30	Bergen	—		Stoke-on-Trent	5ST	384.6	Manchester	2ZY	555.8	Budapest	—
30.2	Hilversum	—		Swansea	5SX	391	Toulouse	—	566	Augsburg	—
37	Vitus (Paris)	—	297	Liverpool	6LV	394.7	Hamburg	—		Cracow	—
37.65	Doeberitz	—		Radio Agen	—	400	Bilbao	—		Hamar	—
61	Paris	Radio L.L.		Hanover	—		Cork	6CK	575.8	Freiburg	—
158	Beziers	—	300	Algiers	—		Cadiz	EAJ3	576	Vienna (Wien)	—
192	Akureyri	—		Bratislava	—		Mont de Marsan	—	588	Zurich	—
200	Biarritz	—	302	Radio Vitus	—		Plymouth	5PY	680	Lausanne	—
204.1	Kaisersleutem	—	303	Nuremberg	—	401	Aachen	—	720	Ostersund	—
217	Radio Luxem-bourg	—	3C4	Casablanca	—	405	Salamanca	EAJ22	760	Geneva	—
			306.1	Belfast	2BE	405.4	Glasgow	5SC	766	Laibach	—
230	Ste. Etienne	—	309.2	Zagreb	—	408	Reval	—	773	Kiev	—
236.2	Stettin	—	310	Oviedo	—	411	Berne	—	995.5	Leningrad	—
283.1	Bordeaux	—	316.2	Marseilles	—	412	Radio Maroc	—	1,000	Leningrad	—
241.9	Muenster	—	312.5	Newcastle	5NO	416.7	Goteborg	—		Basle	—
250	Gleiwitz	—	319.1	Dublin	2RN	422	Cattowitz	—	1,069	Hilversum	HDO
252.1	Bradford	2LS	322.6	Breslau	—	423	Notodden	—	1,080	Strasbourg	—
	Cassel	—	326.1	Bournemouth	6BM	428.6	Frankfort	—	1,111	Warsaw	—
	Montpellier	—	323.9	Almeria	—	434.8	Freidriksstad	—	1,153	Kalundborg	—
256	Kiel	—	330	Königsberg	—		Seville	—	1,180	Stamboul	—
257	Juan-les-Pins	—	333.3	Naples	—	435	Wilno	—	1,190	Boden	—
259	Toulouse	—		Reikjavik	—	441	Brunn	—	1,250	Königswuster-hausen-Zeesen	LP
260.9	Malmo	—	335	San Sebastian	EAJ3	448	Rjuiken	—			
272.7	Sheffield	6FL		Cartagena	—	448.4	Rome	—	1,380	Motala	—
	Bremen	—	337	Copenhagen		450	Moscow	—	1,450	Moscow	RDW
	Danzig	—				453.8	Stockholm	—	1,604	Daventry	5XX
	Klagenfurt	—	340.9	Paris	Petit Parisien	458	Paris Ecole Sup.	—	1,700	Kharkov	—
273	Limoges	—				460	Belgrade	—	1,750	Paris	—
275.2	Dresden	—		Huizen	—	462	Barcelona	—	1,800	Angora	
	Nottingham	5NG	344	Posen	—	470	Langenberg	—		Bucharest	—
277.8	Leeds	2LS	344.8	Barcelona	EAJ1	477.7	Lyons	—		Norddeich	—
278	Grenoble	—	348.9	Prague	—	484.6	Berlin	—	1,850	Carthage	—
283	Cologne	—	353	Cardiff	5WA	491.8	Daventry Ex-perimental	5GB	1,870	Huizen	—
278.8	Bordeaux	—	357.1	Graz	—					Kosice	—
280	Rennes	—	361.4	London	2LO	500	Aberdeen	2BD	1,950	Huizen	—
286	Lille	—	365.8	Leipzig	—	504	Porsgrund	—		Scheveningen	—
288.5	Edinburgh	2EH	370	Paris	Radio LL	508.5	Brussels	—	2,000	Kovno (Kaunas)	—
289.3	Radio Lyon	—	370.4	Bergen	—	517.2	Vienna	—			
294.1	Dundee	2DE	375	Helsingfors	—	526	Milan	—	2,650	Paris	FL
	Hull	6KH		Madrid	EAJ	535.7	Munich	—	2,800	Temesvar	—

This Summer You Are Certain to Need

WEIGHS ONLY 5½ lb.

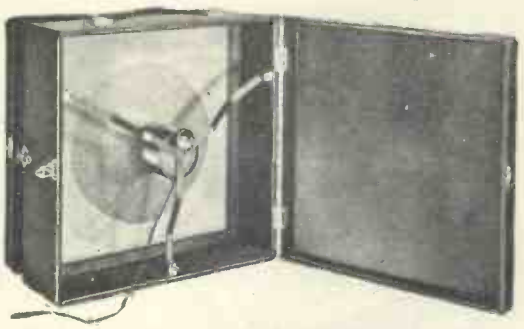
A Portable Cone Loud-speaker

Designed and Built by the "W.M." Technical Staff

NO elaborate introduction is needed to explain the inclusion in the pages of the WIRELESS MAGAZINE of a constructional article dealing with a portable cone loud-speaker. Many readers must have use for such an instrument, which is equally convenient both indoors and out-of-doors. "Portable" is literally correct in this case as the complete instrument weighs only 5½ lb. or so and is not at all bulky.

Better Reproduction

It is well known that a properly-made cone loud-speaker will in most cases give better reproduction than one of the horn type, particularly as regards the bass notes when used in conjunction with an amplifier incorporating one or more stages of resistance-coupled low-frequency amplification.



Back view of the loud-speaker showing how rubber is cut away

Easily Made—At Low Cost

A further, and to the constructor, the greatest advantage of this type of loud-speaker is the fact that it can be so easily made at home at a low cost. Indeed, a home-made cone loud-speaker is within the range of almost every listener's purse.

To get the best results it is found advisable to leave both sides of the cone in "free" air and therefore it is not the best practice to put the cone in a box, at any rate, while it is in use.

In the particular model illustrated on this page, provision has been made so that both front and back of the containing cabinet can be easily opened when the loud-speaker is in use. As a matter of fact, the distance the doors are open effects the tone of reproduction considerably.

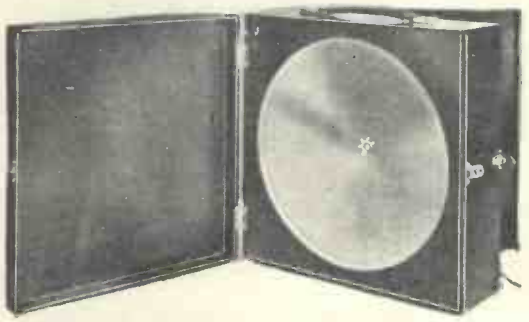
By providing two hinged sides in this way the loud-speaker is adequately protected during transit and when they are opened it can stand upright on even the roughest surface—a point of some convenience when used in the country or by the seaside.

It will be seen that the inside of the cabinet is exactly 13 in. square, a size that will just accommodate a cone made from a piece of paper of 12 in. diameter.

A short distance from the front of the cabinet is placed a ½ in. wood fillet, as can be seen from the diagram on page 374. On to this is screwed the front board which forms a baffle for the cone.

The loud-speaker unit itself is mounted in position by means of three metal strips screwed to small brackets fixed inside the cabinet and the position of the unit can be adjusted by altering the positions of the fixing nuts holding the strips.

Actually, all the essential details are reproduced in these pages, but a full-size blueprint is available for those who desire one. This includes a template for cutting the cone paper exactly to the right size.



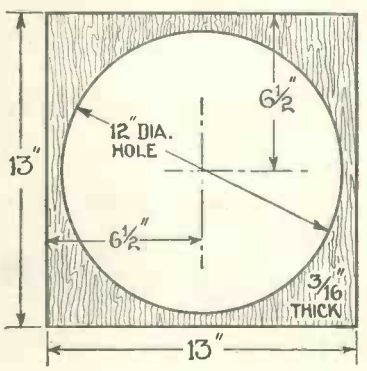
Back and front of the loud-speaker open ready for use

Half-price Blueprints

Copies of the blueprint (No. W.M. 73) are obtainable for half-price, that is 6d. post free, up to the end of May if the coupon on page iii of the cover is used. Address your enquiry to Blueprint Department, WIRELESS MAGAZINE, 58/61 Fetter Lane, E.C.4.

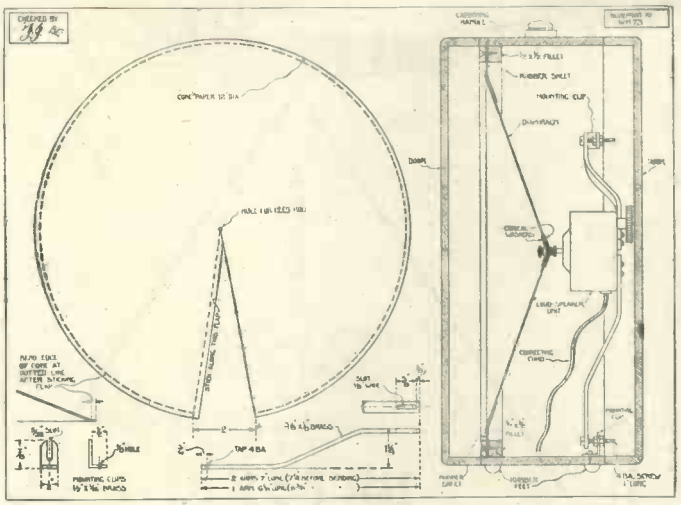
All the necessary parts are detailed

(*Continued on page* 374)



Details of front board or baffle

A Portable Cone Loud-speaker *(Continued)*



This layout can be obtained as a full-size blueprint for half-price, that is, 6d., post free, if coupon on page iii of the cover is used before May 31. Ask for blueprint No. WM73

in the list of components on this page and as soon as they have been obtained work can be started. The dimensions of the fixing strips given are good both for a Goodman's double-acting and ordinary reed unit, but if any other make of unit is used will have to be modified.

Front Board or Baffle

As soon as the cabinet has been bought or built take out the front or baffle (the dimensions of this are indicated on page 372) and glue to the back of it a sheet of thin rubber so that the hole is covered.

To be quite frank, in the original WIRELESS MAGAZINE instrument a rubber apron obtained from a famous sixpenny stores was used with great success!

As soon as this has stuck and the edges have been trimmed off round the wood it can be screwed to the fillets in the cabinet. In this way the rubber is clamped between the front and the fillet.

Next mount the loud-speaker unit in position by means of the small brackets and strips indicated in the layout diagram or blueprint.

Cut out the paper cone, stick along the edges to be joined and leave it to dry. We actually used special gold-finished paper supplied by Goodman's which looks very attractive in the finished model.

As soon as this is dry cut a hole in the rubber sheet about 8 in. or 9 in. diameter and push the apex of the cone through from the front. The extent to which the rubber is cut away is clear from the photograph of the back of the loud-speaker reproduced on page 372.

When the cone has been pushed through, fix it to the reed rod on the loud-speaker unit by means of the conical washers and nuts provided.

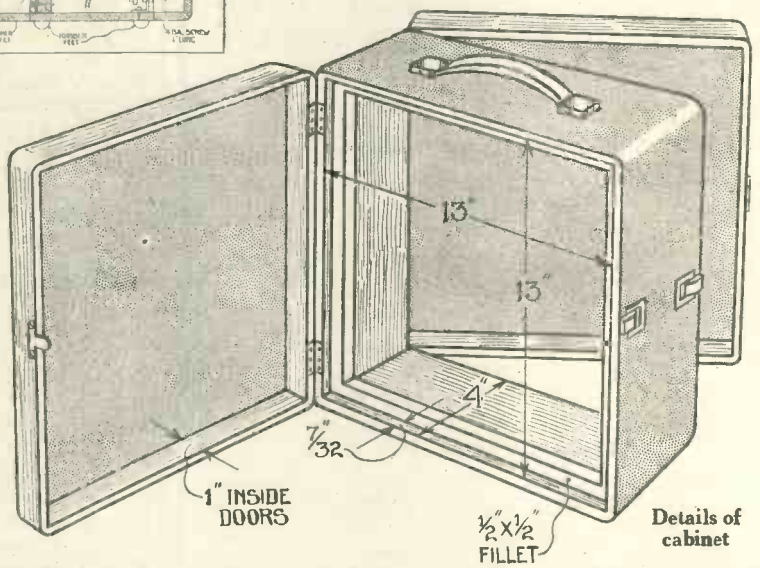
Slight Tension on Rubber

It will be observed that when the cone is properly fixed there is a slight tension on the rubber and an airtight contact is provided without the necessity of actually sticking the cone paper to the rubber. Anybody who wants to try out different kinds of paper for cones will find this is a very convenient method of mounting with which to experiment.

It will be observed that an adjusting nut is provided on the loud-speaker unit and this, in conjunction with the flexible type of bracket mount provided, makes it possible to adjust the unit without difficulty to its most sensitive position.

Readers' Hints Welcomed

By the way, although it is true that too many cooks often spoil the broth, thousands of heads are sometimes better than a few dozen (even if the latter are specialised!) and the WIRELESS MAGAZINE will always be glad to hear from any of its readers who have new constructional ideas for such instruments as this.



Details of cabinet

COMPONENTS REQUIRED

1—Cone loud-speaker unit (Goodman's double-acting or ordinary reed, Lissen or Bullphone).
1—Piece of cone paper, 12 in. square (Goodman or Six-Sixty).
2—7¼ in. lengths brass strip, ½ in. by ⅛ in. (Goodman).
1—6⅜ in. length similar brass strip (Goodman).
3—1½ in. lengths brass strip, ½ in. by ⅛ in. (Goodman).
1—Rubber apron (price 6d.).
3—1 in. 4B.A. brass screws, each with two nuts.
3—¼ in. wood screws.
4—½ in. wood screws.
1—Cabinet with front board (Edwards).

All About Moving-coil Loud-speakers in the Next Issue!

The Sunshine Five (*Continued from page 298*)

Having made or acquired the cabinet, the first operation is the mounting of the receiver and the winding of the frame. The loud-speaker framework is provided with three radial arms, having holes 2 in. or 3 in. from the centre. Mark out the holes in the grille to correspond with the holes in the framework.

The loud-speaker may then be held in position by three 4B.A. screws, placed through from the outside and held in position by a nut at the back.

The Sunshine Five in use

Take it on high ground if you can!

The loud-speaker should be arranged so that the two leads come at the bottom right-hand corner of the grille, where two holes are ready drilled for them.

Winding the Frame Aerial

The next operation is the winding of the frame, and this must be done exactly as shown in the diagram. The short-wave frame is a simple single-layer winding, a close winding of 14 turns of No. 22-gauge d.s.c. wire being adopted. For the long-wave frame a three-section winding is adopted, the former being slightly slotted. Each section contains 23 turns of No. 28-gauge d.s.c. wire, making 69 turns in all for the complete long-wave portion.

It should be noted that the short-wave frame is placed at the back of the former as far away as possible from the earthed metal of the loud-speaker. The *end* of the long-wave frame is connected to the *end* of the short-wave frame and three connections are brought out from the two sections.

This arrangement enables the two frames to be put in parallel on the short waves, which has been found to give greater efficiency than short-circuiting the long-wave portion. For the long waves the short-wave frame is left "in the air," this producing no serious effects.

Earthing the Loud-speaker

The three points of the frame should be connected to flexible leads which are anchored in some suitable fashion and passed through the holes provided for them in the front. Before leaving this portion of the construction, the metal of the loud-speaker must be earthed, and since one side of the frame is always connected to L.T.—, this may conveniently be done by taking a wire from the framework to the black flexible lead from the frame.

Incidentally, this connection of all metal parts to earth, or in this case to L.T.—, is an essential feature of the receiver, for unless this is done great trouble is liable to arise. The metal work of the switch in the receiver itself, and the metal cases of the two transformers, are all definitely connected to L.T.— to avoid difficulty.

Assembling the Receiver Unit

The construction of the receiver proper may then be accomplished. The components have been arranged in a three-bay formation. The H.F. components are at one end, the detector components along the middle

(*Continued on page 378*)

The Sunshine Five *(Continued)*

and the L.F. along the other end. The front of the baseboard is therefore cut away slightly in the middle and the panel is set back a short distance.

The H.F. unit is mounted at the left-hand side of the panel on the baseboard, the two Mullard transformers are mounted just to the right of the centre and the two L.F. valve holders are mounted on the right-hand bay. The panel merely contains the tuning condenser, the reaction condenser—a Gambrell Neutovernia—and the range switch.

Aerial and Filament Switch

This switch controls the frame and filament circuits. In the middle position, the filaments are switched off. In the one position the filaments are switched on and the frame is connected in the short-wave position, while in the opposite position the long-wave connection is adopted, the filaments again being switched on. The one switch therefore controls the whole circuit.

The actual position which these components will occupy is clearly indicated in the diagrams accompanying this article.

Mark out the panel and mount the components in their proper positions first of all. Then lay out the components on the baseboard as indicated by the wiring diagram and place the panel temporarily in position in order to ensure that there is adequate clearance. There is naturally very little latitude in the spacing of these components, and the layout must be followed rigorously.

Before wiring up is commenced the detector potentiometer must be made. This consists of 8 yards of No. 43-guage enamelled Eureka wire wound on a ¼ in. ebonite rod, a tapping being taken at 2 yards. This gives a resistance of 500 ohms with a tapping one quarter of the way along from the negative end.

Wiring Up the Receiver

The receiver portion may then be wired up, and the early stages of this may be conducted without the panel in position. The connections between the H.F. unit and detector and the majority of the L.F. connections may be completed at this stage. The panel may then be mounted in position and the remaining wires connected up.

The actual battery connections are made by a battery cord taken to the appropriate points on the circuit. It should be noted that the high-tension connection to the H.F. unit is brought by means of a stiff wire to a binding post at the right-hand end of the panel looking from the back. The H.T. connection is then taken to this point.

Making the Binding Post

The binding post is formed by a simple screw passing through the ebonite, and on the front side of the panel a nut and washer is provided which enables the loud-speaker to be connected up when the receiver portion is placed in position. Similarly two of the frame connections are brought to screws passing through

(*Continued on page* 380)

VALVES TO USE IN THE SUNSHINE FIVE

Make.	*1st H.F. and Detector.*	*2nd H.F.*	*1st L.F.*	*2nd L.F.*
B.T.H.	B210H	—	B210L	B215P
Cossor	210RC	210LF	210LF	220P
Cosmos	SP18B	—	SP18R	SP18RR
Ediswan ...	—	DR2	GP2	PV2
Marconi	DEH210	HL210	DEL210	DEP215
Mullard	PM1A	PM1HF	PM1LF	PM252
Osram	DEH210	HL210	DEL210	DEP215
Six-Sixty... ...	SS210RC	SS210HF	SS210LF	SS230SP

The Sunshine Five *(Continued)*

the panel at the opposite end of the receiver, the third connection going direct to the H.F. unit.

The receiver is now ready for mounting. It should be placed in the recess provided for it with the baseboard towards the back and the panel uppermost. It may then be held in position by means of wood screws passing through the baseboard into the wooden partition behind.

Connecting Up Accessories

It now remains to connect up the batteries, the loud-speaker and the frame aerial. The battery cord is passed through the slot cut for it in the partition. The two loud-speaker leads are connected direct to the appropriate points. The back lead is connected to the anode terminal on the last valve holder, while the red lead is connected to the H.T. binding post previously referred to.

The frame leads are brought straight across the battery compartment, through the three holes provided for them and are connected up as follows: The red lead goes to the grid terminal on the H.F. unit. The second lead, coloured maroon in my model, passes to the first binding post, while the black lead passes through the second binding post, which is connected to L.T.—. It is now only necessary to connect the leads to the batteries in order to complete the assembly.

The valves may then be inserted by opening the flap at the end of the set. Recommended valves are shown in the table on page 378. A peculiarity of the set is that the second H.F. valve is somewhat microphonic, and owing to the fact that this is mounted in a rigid holder trouble may arise from this source. It is advisable, therefore, to choose a good valve for this position. The detector valve is also microphonic to a somewhat lesser extent. It is a good plan to pack the two H.F. valves with cotton-wool, as this avoids shock.

Sound Waves from Loud-speaker

This is particularly important in between the top cover and the valves, for it is here that sound waves from the loud-speaker impinge. Trouble of this sort is always serious with portable receivers, and it is worth a little time finding the best valve for the particular position.

The detector H.F. voltage should be between 50 and 60 volts, the best position being found by trail. The other H.T. tap is plugged into the full amount. Then on switching on the receiver no trouble will be found in finding the various stations.

The test report accompanying this article gives some idea of the stations which have been received at Elstree after dark. (See page 298).

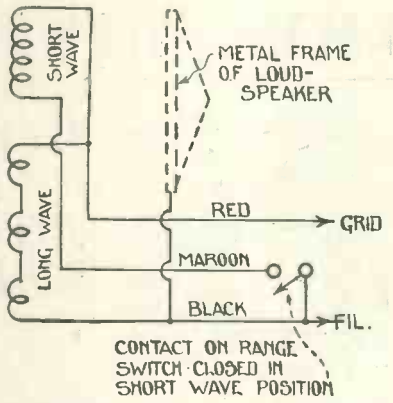


Diagram showing frame aerial and loud-speaker connections

Those marked * can be received at comfortable loud-speaker strength during daylight; and this, of course, is the most important feature, since the set will normally be used during the daylight hours. Pressing the switch away from one sets the receiver in the short-wave position, while pulling towards one changes the connections for long-wave reception.

Handling the Reaction Control

The reaction control will be found to increase as the wavelength is reduced, this being a peculiar feature of the receiver and one which makes it rather different from the usual.

In searching for stations, therefore, it is best to run up from the bottom of the scale, gradually reducing the reaction as required, and in this way no trouble will be found in plotting a number of stations which may be duly recorded on the station log mounted on the cover plate.

The Formodensor across the first transformer must be adjusted to give the required reaction effect on the whole range. It should be about the middle of its travel. Swinging the knob in decreases the reaction effect, and vice versa.

The Vogt Electrostatic Loud-speaker

A NUMBER of WIRELESS MAGAZINE readers were particularly interested in the description of the Vogt electrostatic loud-speaker which was fully described in our previous issue ("Some New German Loud-speakers," page 212).

We are lad to be able to inform them that these loud-speakers can be obtained in England from A. M. Sherwood, of 68 Hatton Garden, London, E.C.1.

This firm were good enough to let us have one of the loud-speakers for test and we found that with a well-designed amplifier the quality of reproduction was very good indeed.

The loud-speaker will appeal particularly to experimenters for the principle on which it works is quite new to most British amateurs

TEST REPORT OF THE CRUSADER
(see page 322)

Station	Wave-length	Aerial Condenser	Reaction Condenser
Vienna ...	517	147°	139°
Brussels ...	508	139°	134°
Daventry (5GB)* ...	492	133°	132°
Berlin ..	483	127°	130°
Langenberg*	470	123°	128°
Rome ...	452	112°	123°
Frankfurt*	428	108°	122°
Kattowitz	422	102°	120°
Hamburg*	396	90°	116°
Stuttgart. .	379	83°	112°
London (2LO)* ...	361	75°	109°
Bourne-mouth ...	326	60°	100°
Nuremberg	303	49°	92°
Cologne ...	278	42°	83°

* Received at loud-speaker strength. Coils used were: Aperiodic, No. 35; Grid, No. 60; Reaction, No. 50

Station.	Wave-length	Aerial Condenser	Reaction Condenser
2NM* ...	32.5	12°	130°
Eindhaven	30.2	49°	52°
PCMM ...	—	44°	47°
2XAD ...	21.9	28°	42°

Coils used were: Aperiodic, No. 2; Grid, No. 4; Reaction, No. 6.
* Coils used were Nos 2, 6, and 4 in above order.

WHAT IS WRONG WITH BROADCAST DRAMA?

To the Editor, WIRELESS MAGAZINE.

SIR,—In your April issue there appeared an article by me on broadcast drama.

In view of recent events it seems that the article in question must now show up in rather a poor light. We have had *The Master Builder*, which was magnificently done. We have had an extraordinarily fine piece of work from the pen of Mr Cecil Lewis in the shape of *The Night Fighters*. And we have been given a very rare treat in *The Man of Destiny*.

If such material is going to be the foundation of broadcast drama in the future, then it is very possible that the radio play will develop into a genuine means of artistic expression In fact, after having heard *The Night Fighters* and the splendid message it put over, one is almost inclined to think that such a condition has already come about; and the special drama station would consequently not be quite such a "loathsome" thought.

No doubt if the B.B.C. gave the public any large number of plays which could by any conceivable means be regarded in the light of pamphleteering, righteous people in Golders Green and Tooting would stand on their hind legs and yap. But that does not matter in the least. They are the very same people who think Noel Coward ought to be in prison. Mr Shaw was hailed as a pamphleteer at first and some peculiar people look upon him in the same light to-day, but the majority prefer to call him a very great artist.

If the B.B.C. are going to put out plays which are truly artistic in that they are didactic, then the public should give three cheers for the dramatist who adapts himself to the new method of expression and another three cheers for Mr. Cecil Lewis, who has practically created that method.—DALLAS BOWER (Brighton).

RECEPTION FROM POLAND

To the Editor, WIRELESS MAGAZINE

SIR,—While looking through a recent issue of the WIRELESS MAGAZINE, I noticed that Jay Coote, in his "Continental Notes," said he doubted very much whether the Wilno station would be heard on this side of the Channel.

In this connection it may interest your readers to hear that I picked up this station quite easily on a simple two-valver (detector and L.F.).

This may have been in the nature of freak reception; but on several evenings recently I have heard the Posen station at quite good strength. A few nights ago, when Posen was relaying a programme from Warsaw, the interval signal consisting of the morse letter W, could be heard quite distinctly on a small loud-speaker at a distance of a foot or so from the horn.—W. OLIVER (Wandsworth Common).

"Wireless Magazine" REFERENCE SHEETS

Compiled by J. H. REYNER, B.Sc., A.M.I.E.E.

Month by month these sheets can be cut out and filed—either in a loose-leaf folder or on cards—for reference. The sequence of filing is a matter for personal choice. In a short time the amateur will be able to compile for himself a valuable reference book.

WIRELESS MAGAZINE Reference Sheet — *No. 61*

Three-stage Power Amplifier

THE construction of a three-stage (four-valve) L.F. amplifier is not an easy matter owing to the great tendency for feed-back, due to the common impedance of the battery or battery eliminator used to supply the high-tension voltage.

With an odd number of stages the effect is positive and definite reaction effects are produced, which, even if they do not cause oscillation or "motor-boating," will give rise to serious distortion. With even numbers of stages the effect is negative and causes a reduction in the amplification, which again introduces distortion, for the regeneration varies with different frequencies.

Any really distortionless amplifier, therefore, must take account of this feed-back, due to the common impedance, even when batteries are being used, while if the battery eliminator is employed, the relatively larger impedance of the filtering circuit inevitably introduces trouble unless special precautions are taken in the amplifier itself to combat the effect.

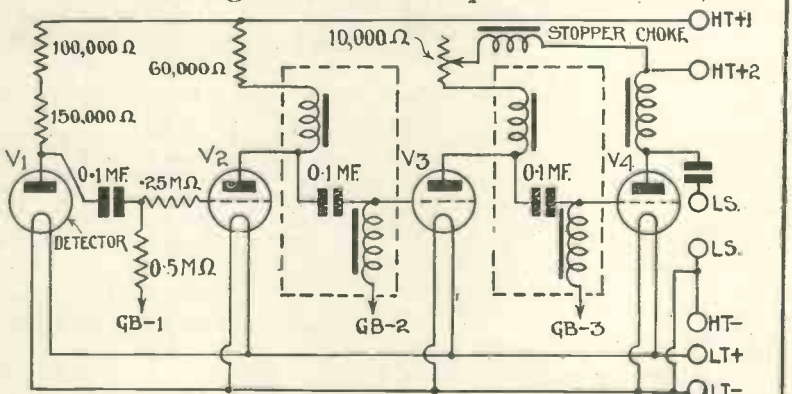
The amplifier shown on Sheet No. 62 was particularly designed to overcome this trouble. It was used in the WIRELESS MAGAZINE Laboratories with an eliminator delivering 300 volts, but the system shown could be used satisfactorily on smaller voltages, in which case the resistances in the anode circuits would have to be suitably reduced. In the first place two entirely separate filter circuits were employed in the eliminator, these being connected to H.T.+1 and H.T.+2 on the amplifier. The voltage on these two points was equal, but they were supplied through separate circuits. Secondly, the detector and first L.F. valves were fed through resistance-capacity filters. This is a well-known method for stopping "motor-boating," and was referred to in Sheet No. 43.

On the second L.F. valve, the actual voltage on the anode was required to be higher than before, and in consequence a resistance of the order of 50,000 ohms could not follow it, and a value of something nearer 10,000 ohms was used. This is insufficient to act as a resistance-capacity filter, and it was necessary to insert a choke in this lead. The last valve has the full high-tension supply to the anode, a choke output circuit being used for the loud-speaker.

Dual-impedance couplers were used for the last two stages, a simple resistance-coupling stage being employed in the first. The valves employed are specified on Sheet No. 62.

WIRELESS MAGAZINE Reference Sheet — *No. 62*

Three-stage Power Amplifier (*Continued*)

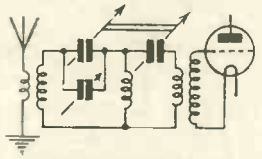


The design of this amplifier has been discussed on Sheet No. 61. The values of the components are marked on the diagram above. The following valves were used:—V1, Cossor 610 H.F.; V2, Cossor 610 L.F.; V3, Cossor 610 P (Stentor Six); V4, L.S. 5 A. Valves of other makes having similar characteristics may, of course, be substituted for those shown if desired

WIRELESS MAGAZINE Reference Sheet *No. 63*

Vreeland Circuit

ONE of the principal difficulties which arises in a high-frequency amplifier is that of obtaining the necessary fidelity of reproduction consistent with sharp tuning. For satisfactory quality, it is necessary that the circuit shall receive all frequencies within at least 5 kilocycles on each side of the resonant point, and it should theoretically give all such frequencies equal preference.



Vreeland Circuit

Outside this limit, however, it should cut off very rapidly in order that any interference may be tuned out as completely as possible. The ordinary resonance curve is incapable of producing an effect of this nature, for it gives a sharp response at the resonance point, but falls away rapidly on either side, so that the higher frequencies are not received in their proper proportion.

To overcome this difficulty, a series of cascade circuits is usually employed, these circuits being incorporated in a high-frequency amplifier. Even this method is not always satisfactory where extreme selectivity is required, and the circuit illustrated in the diagram has been evolved by Doctor Vreeland, in America, to give a definitely flat-topped resonance curve.

It will be seen that there are two tuned circuits coupled to each other through a common inductance, and both tune together with a gang condenser. Any two circuits so coupled will produce a double-hump resonance curve having two peaks, which may be close together or far apart, according to the extent of the coupling between the circuits. By suitable adjustment of the coupling, these two humps can be made to occur close together, so giving a flat-topped resonance curve with steep sides.

This is just what is required for extreme selectivity with good quality, and is the object in view in utilising this special arrangement.

WIRELESS MAGAZINE Reference Sheet *No. 64*

Metal Rectifiers

A FORM of rectifier which is likely to prove popular in the future is the Westinghouse metal rectifier. This consists of discs of copper and cuprous-oxide in contact. Such a combination has the property of passing current much more easily in one direction than in the other.

A rectifier unit is built up as follows: There is first a thick disc of copper. Then a disc of lead, followed by a second thin disc of copper. Next is a thin copper disc oxidised on the top side, followed by a second disc of lead, and a second thick disc of copper completes the assembly.

The active elements are the thin copper and oxidised copper discs in the centre. The lead discs are placed to ensure good contact and the thick discs on the outside are to give the whole unit rigidity. The unit is clamped together with a strong pressure, and is thus permanent in its characteristic.

The actual forward resistance of a rectifier unit (that is, the resistance in the direction for which the unit is a conductor) varies with the actual size, but is usually a small fraction of an ohm only, so that the voltage drop on the rectifier is comparatively small. The reverse resistance is well over 1,000 times as high, and thus very little reverse current flows. The arrangement forms a simple and efficient rectifier, which can be built up into various formations for use with the circuit required.

The principal disadvantage of such units is their inability to stand prolonged overload. If

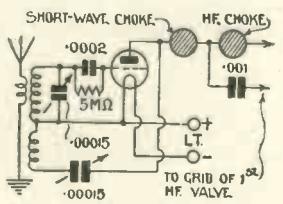
Arrangement of Metal-oxide Rectifier

the current exceeds the rated value for a considerable period, excessive heat is generated and the oxide coating on the rectifier disc is destroyed. Provided reasonable care is taken, however, no difficulty of this nature arises in practical use and the unit is no less serviceable on this account, for a valve rectifier will not stand an overload for any prolonged period.

WIRELESS MAGAZINE Reference Sheet *No. 65*

Short-wave Adapter

THOSE readers who have receivers including two stages of high-frequency amplification can turn their sets into efficient short-wave receivers by adding superheterodyne adapters on the front. This consists of a suitable oscillating detector, which converts the received short-



Short-wave Adapter Circuit

wave oscillations into a much lower frequency within the normal broadcast band.

To operate the arrangement, the broadcast receiver is tuned in to some definite wavelength. The aerial is then removed and connected to the short-wave adapter. The short-wave signals are then tuned in on the adapter, using this as superheterodyne receiver in the normal manner while the broadcast receiver acts solely as an intermediate and low-frequency amplifier and is not touched.

Owing to the removal of the aerial from the first circuit, it may be necessary to retune the circuit again in order to obtain the best results. After this has been done, the exact settings on the various condensers should be noted for future reference, so that the broadcast receiver can always be set in a suitable position for receiving the short waves.

A diagram of connections, with values, is appended. A short aerial system only should be used to minimise the radiation from the continuously oscillating detector, but as this oscillation is different from that being received, it will not cause interference to others receiving the same programme.

Test Report of All-the-World Five

Station	*Anode Condenser Readings*
Stettin	5
Muenster	10
Cologne	18
Nuremberg	26
Breslau	34
Petit Parisien	55
London	65
Madrid (EAJ7)	72
Kattowitz	78
Frankfurt	82
Rome	95
Paris (Ecole Sup.)	100
Langenberg	110
Daventry (5GB)	115
LONG-WAVE STATIONS	
5XX	145
Hilversum	90

The above test report refers to the receiver described on page 107 of the March WIRELESS MAGAZINE.

Sifam H.T. Voltmeter

IN our previous issue (page 282) we reviewed a Sifam H.T. Voltmeter. This instrument has been specially designed for testing mains units where a very low current consumption is required. The consumption on a full-scale deflection, however, was stated in our test report to be 8 milliamperes, whereas it should be 1.8, this figure corresponding to a resistance of nearly 1,250 ohms per volt. Such a meter would consume only a fraction of the total current flowing in ordinary practice since receivers demanding as much H.T. as 200 volts would normally consume at least 10 milliamperes, and probably considerably more, while receivers of smaller current consumption would only require 100 or 120 volts, in which case the current taken by the meter would be less than .1 milliampere.

Catalogues and Pamphlets

A LITTLE booklet from Gambrell Bros., Ltd., of 76 Victoria Street, S.W.1, gives some interesting information on the subject of Gambrell components.

An attractive and fully illustrated catalogue of Deckorem products has been sent in by A. F. Bulgin & Co., of 9-11 Cursitor Street, Chancery Lane, E.C.4.

The "lateral action" condenser is dealt with in a leaflet from Ripaults, Ltd., of King's Road, N.W.1.

The Dubilier Condenser Co. (1925), Ltd., of Ducon Works, Victoria Road, North Acton, W.3, have sent in a recent issue of their catalogue and price list.

From J. J. Eastick and Sons, of Eelex House, 118 Bunhill Row, E.C.1, we have received a catalogue of apparatus.

Index to Advertisers

The NEW WONDER TRANSFORMER WITH THE SILVER WINDING AND THE MULLARD PERMACORE

PRICE **25/-**

THE new Mullard "Permacore" Transformer is absolutely revolutionary in design and construction. No transformer so compact and at the same time so efficient has ever been produced. It is a master product giving better results than the best of the big ones. The reasons are these :

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