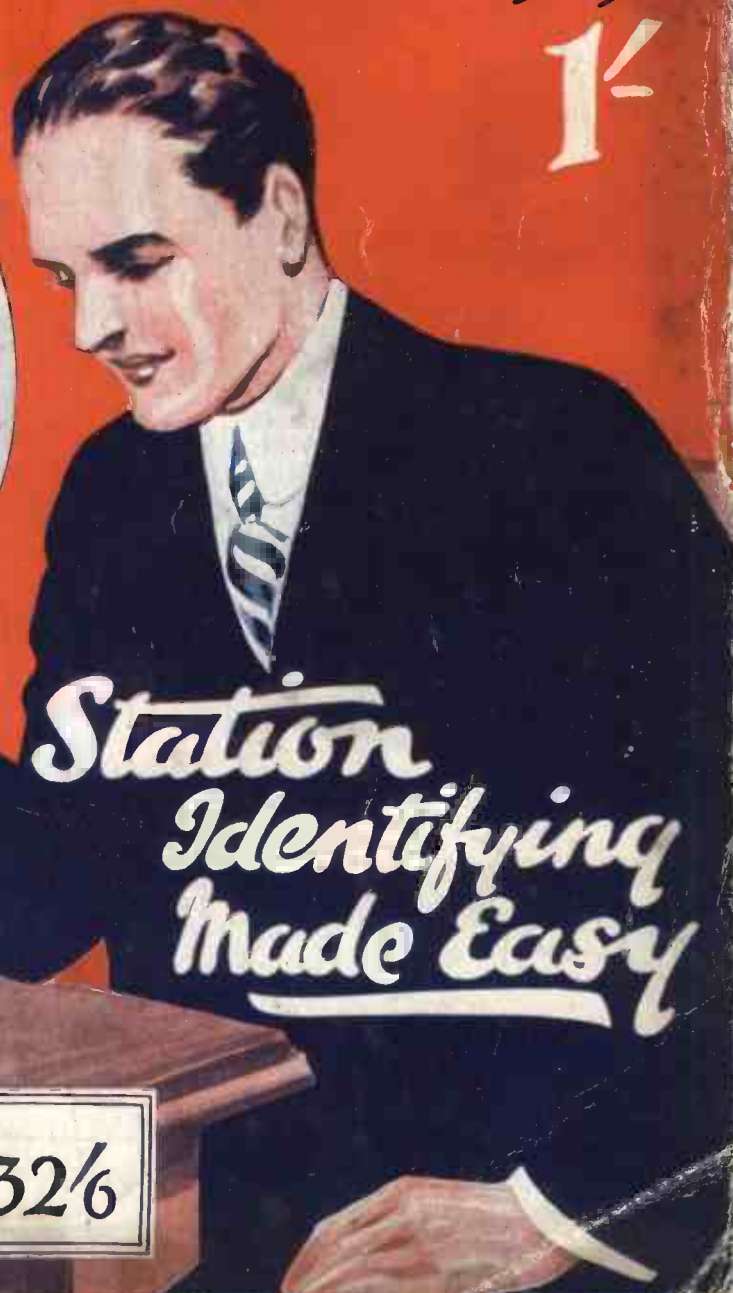
CHOOSING YOUR NEW-YEAR SET

SPECIAL FOR HOME CONSTRUCTORS

Wireless Magazine

VOL. 8. No. 48. JANUARY, 1929.

1/-

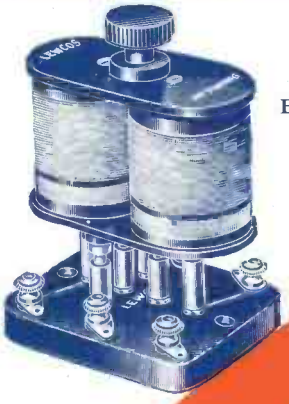


Station Identifying Made Easy

BUILD THIS STATION IDENTIFICATION WAVEMETER *for* 32/6

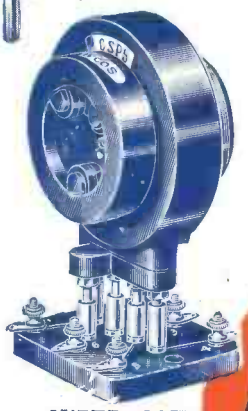
EVERY LEWCOS COIL IS DESIGNED *SPECIALLY* TO GIVE IMPROVED RECEPTION

CENTRE TAPPED COIL
Pat. No. 271,384

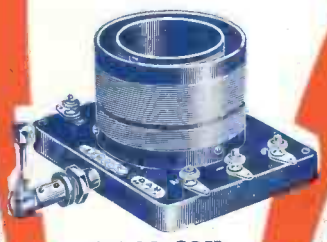


BINOCULAR COIL
Pat. No. 277,876

H.F. CHOKE



SUPER COIL
Pat. No. 285,723



Q.A.M. COIL

LEWCOS engineers are occupied year in and year out on problems connected with the improvement of radio reception—inductive coupling, minimum self-capacity and low H.F. resistance—these are factors demanding continuous experiment and research, the result of which is shown in the remarkable superiority of LEWCOS Coils.

Many of the most successful receivers last year depended in a large measure on the high efficiency of LEWCOS Coils, therefore take the advice of the Technical experts of the "Wireless Magazine" and use LEWCOS Coils in your set to enjoy REAL RADIO RECEPTION.

LEWCOS

RADIO PRODUCTS REGD.

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED
Church Road, Leyton, London, E.10
Trade Counter and Cable Sales: 7 Playhouse Yard, Golden Lane, E.C.1

H.F. Transformer for Touchstone Receiver

Editor:
BERNARD E. JONES

Technical Editor:
J. H. REYNER, B.Sc. (Hons.), A.M.I.E.E.

Wireless Magazine

The Best Shillingsworth in Radio

Vol. VIII :: JANUARY, 1929 :: No. 48

Research Consultant:
W. JAMES

Assistant Editor:
D. SISSON RELPH

OUR SHOW WINDOW

IF you don't land every fish you hook, it is equally true that you don't identify every station you hear. Our national inability to understand the foreign tongue is partly the cause of this, as J. Godchaux Abrahams, himself a first-class linguist, well knows; for in his article in this issue, "How to Recognise Those Foreign Stations," he gives just the information that most ether-searchers will find helpful.

We feel that with Mr. Abrahams's article and with the Station-identification Buzzer Wavemeter—which can be built at a cost of just over 30s. from instructions in this issue—everybody will have the means of identifying the broadcast foreigner whenever they may happen to "meet" him.

L.F. TRANSFORMERS *Capt. Round's article this month, discussing problems in L.F. transformer design, provides the key to the high efficiency of so many of the most modern transformers, namely, the core of permalloy or special iron which allows of compact design.*

J. H. Reyner, whose Furzehill Four looks like being a big success, has some more to say in this issue about this set; and this reminds us that the Touchstone—the set described in the November issue by W. James—still continues to be a great favourite, the blueprint sales being remarkable.

More and more, by the way, is the reader taking advantage of the privilege of buying a selected blueprint at half-price, but as to this, one special request, please! Do send postal orders *when you ask for blueprints.*

NEW S.G. FOUR *The sets in this issue are, I hope, representative. Heading the list is a new set by W. James, The Binowave Four, which includes new dual-range coils designed specially for use with screened-grid valves.*

In the Standard-coil Three we have a straightforward circuit giving exceptional results with standard two-pin plug-in coils. The Festival Three is a local-station set with all-wave tuner and provides facilities for reproducing gramophone records.

Then, finally, there is the Wide-World Short-waver, a screened-grid valve set, which under favourable conditions ought to have a practically unlimited range.

The Inceptor 3, of which we presented a free blueprint with the October issue, still continues to interest and attract our readers. J. Godchaux Abrahams has made it his special business to carry out still further tests with this set and you have the benefit of his final report in our pages this month.

J. H. Reyner's article on the gramophone pick-up deals with the effects of over-damping and under-damping in the reproduction of musical sounds, while W. James, in his special article this month, discusses faults in moving-coil loud-speakers and how to overcome them.

I am not too late, I hope, to wish you a good time this Christmas. May 1929 be a year of success with you all!

Bernard E Jones

Do Not Overlook the Half-price Blueprint Coupon on Page iii of the Cover

CONTENTS

Published by BERNARD JONES PUBLICATIONS, LTD., publishers of "Wireless Magazine" and "Amateur Wireless." Editorial and Advertisement Offices: 58/61 Fetter Lane, London, E.C.4. Telephone: City 3733, 3734. Telegrams: "Beejapee, Fleet, London." Published about the 25th day of the month and bears the date of the month following. Subscription: Great Britain and Abroad, 15s. 6d. a year, post free (Canada only, 13s. 6d.). Contributions are invited and will be promptly considered.

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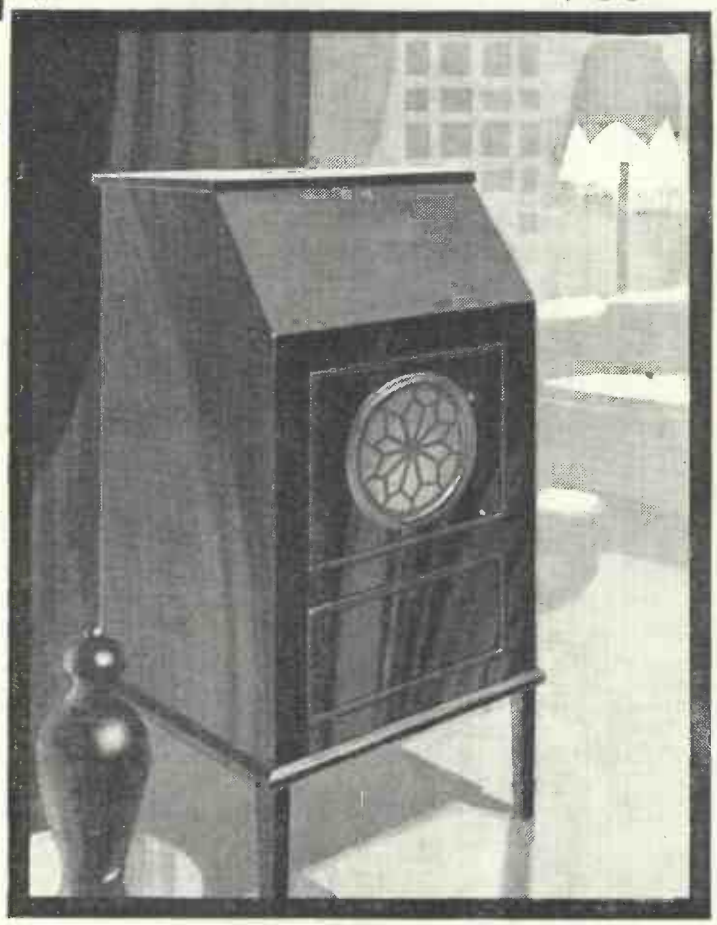
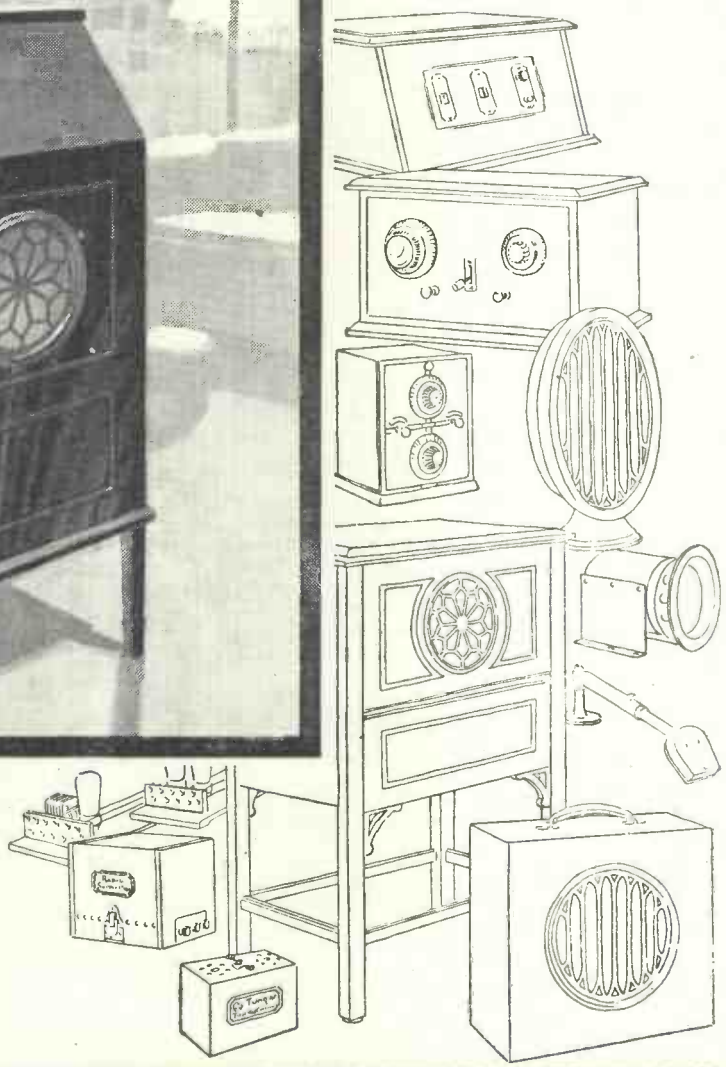
Christmas Presents





THE B.T.H. DE LUXE EQUIPMENT

This is the last word in high-class radio equipment and consists of Receiver and R.K. Reproducer, both operated from the mains. Two stages of screened grid H.F. amplification are employed. The output stage is coupled to the R.K. Reproducer Amplifier. The equipment is supplied for 200/250 and 100/125v. 25/30 or 40/100 cycle A.C. supply or 200/250v. D.C. supply. There are two tuning ranges, controlled by a switch, covering 250/500m. and 1000/2000m. Extremely long range reception is obtainable. Provision is made for employing an electrical pick-up.

PRICE: £110 including valves and royalties.

B.T.H. RADIO

3150.

# of pre-eminent Value

THE instrument illustrated in the panel will appeal to all as the very finest radio Christmas present it is possible to give or receive.

It is a 5-stage completely mains operated receiver with the world-famous R-K reproducer fitted in the cabinet.

The B.T.H. Range of radio apparatus is illustrated on these pages. There are gifts ranging in price from 10/6 to £110. All are of the very finest quality and workmanship, fully up to the high standard implied by the B.T.H. monogram.

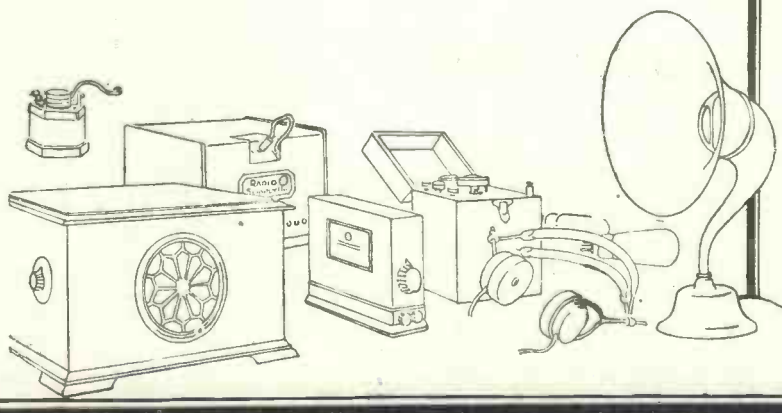
Select your gift this Christmas from this new and wonderful range. Such a gift is sure to please and will reflect the sound judgment and good sense of the donor.

Ask your dealer to-day for full particulars of any or all of the items illustrated.

The Range of B. T .H. Apparatus

Pijou Crystal Receiver.
Two Stage Receiver.
Three Stage Receiver.
Five Stage Receiver.
De Luxe Equipment.
Portable Receiver.
Cone Loud Speaker.
Type C2 Horn Speaker.
R.K. Moving Coil Reproducer Unit.
Junior R. K. Reproducer (A.C & D C.) Table Grand and De Luxe Models.
Senior R.K. Reproducer.
5 m.a. H.T. Battery Eliminator.
10 m.a. H.T. Battery Eliminator.
Junior R. K. Elimi ator (A.C. & D C. Models).
Pick-up Amplifier, Scratch Filter and Volume Control.
Junior R.K. Amplifier (without R.K. Unit).
Pick-up and Tone Arm.
Electric Gramophone Motor.
Two Stage Unit.
Tungar Trickle Charger.
Power Control Switch.
Headphones.
Transformers.
R.C.C. Units.
Etc , Etc.

In addition, an extensive range of the new M zda Nickel Filament valves covering every requirement of the 2, 4, and 6 volt user.



B T-H

APPARATUS

The British Thomson-Houston Co. Ltd., Crown House, Aldwych, London W.C.2.

VALVES TO USE IN THIS MONTH'S SETS

TWO-VOLT VALVES: Three-electrode Types

Make.	Type.	Impedance.	Amp. Factor.	Fil. Volt.	Fil. Cur.
Ediswan	RC2	150,000	30	2	.1
Mazda ...	RC210	86,000	40	2	.1
Mullard...	PM1A	72,000	36	2	.1
Cosmos ...	SP16B	70,000	35	1.8	.09
Six-Sixty	210RC	68,000	35	2	.1
Ediswan	RC210	67,000	40	2	.1
Cossor ...	210RC	60,000	40	2	.1
Marconi...	DEH210	50,000	35	2	.1
Osram ...	DEH210		35	2	.1
Mazda ...	HF210	28,000	20	2	.1
Six-Sixty	210HF	27,000	13	2	.1
Ediswan	HF210	25,000	20	2	.1
Mullard...	PM1HF		14	2	.1
Marconi...	HL210	23,000	20	2	.1
Osram ...	HL210		20	2	.1
Cossor ...	210HF	20,000	15	2	.1
Six-Sixty	210LF	18,000	8.5	2	.1
Cosmos ...	SP16G	17,000	16	1.8	.09
Mullard...	PM1LF		8.5	2	.1
Mazda ...	GP210	14,000	13	2	.1
Ediswan	LF210	13,000	13	2	.1
Cossor ...	210LF	12,000	10	2	.1
Marconi...	DEL210		11	2	.1
Osram ...	DEL210		11	2	.1
Mullard...	PM2DX	10,700	13.5	2	.25
Cosmos ..	SP16R	10,000	9	1.8	.09
Six-Sixty	215P	7,300	6.4	2	.15
Mazda ...	LF215	7,000	7	2	.15
Mullard...	PM2		6.2	2	.15
Ediswan	PV215	6,600	8	2	.15
Cossor ...	220P	5,000	5	2	.2
Marconi...	DEP215		7	2	.15
Osram ...	DEP215		7	2	.15
Cosmos ...	SP18RR	4,500	6.5	2	.3
Cossor ...	220P	4,000	8	2	.2
Six-Sixty	230SP		3.9	2	.3
Mullard...	PM252	3,800	3.8	2	.3
Mazda ...	P227	2,900	4	2	.27
Ediswan	PV225	2,700	3	2	.25
Marconi...	DEP240	2,500	4	2	.4
Osram ...	DEP240		4	2	.4
Cossor ...	230XP	2,000	4	2	.3

FOUR-VOLT VALVES: Three-electrode Types

Make.	Type.	Impedance.	Amp. Factor.	Fil. Volt.	Fil. Cur.
Mazda ...	RC407	100,000	40	4	.075
Six-Sixty	4075RC	64,000	34	4	.075
Mullard...	PM3A	63,000	35	4	.075
Ediswan	RC410	61,000	40	4	.1
Cossor ...	410RC	60,000	40	4	.1
Marconi...	DEH410		40	4	.1
Osram ...	DEH410		40	4	.1
Ediswan	HF410	22,000	25	4	.1
Mazda ...	HF407	21,000	18	4	.075
Cossor ...	410HF	20,000	20	4	.1
Six-Sixty	4075HF	16,500	13	4	.075
Mullard...	PM3	16,000	13.5	4	.075
Mazda ...	GP407	14,000	14	4	.075
Ediswan	LF410	10,500	13	4	.1
Cossor ...	410LF	8,500	15	4	.1
Marconi...	DEL410		15	4	.1
Osram ...	DEL410		15	4	.1
Six-Sixty	410P	8,000	7.3	4	.1

FOUR-VOLT VALVES—*Continued*

Make.	Type.	Impedance.	Amp. Factor	Fil. Volt.	Fil. Cur.
Mullard...	PM4DX	7,500	15	4	.1
Mullard...	PM4	7,000	7	4	.1
Mazda ...	LF407	5,700	8	4	.075
Ediswan	PV410	5,500	5.5	4	.1
Marconi...	DEP410	5,000	7.5	4	.1
Osram ...	DEP410		7.5	4	.1
Ediswan	LF410a	4,500	9	4	.1
Cossor ...	410P	4,000	8	4	.1
Six-Sixty	425SP	3,600	3.2	4	.25
Mullard...	PM254	3,500	3.15	4	.25
Mazda ...	P415	2,900	5.5	4	.15
Marconi...	P425	2,250	4.5	4	.25
Osram ...	P425		4.5	4	.25
Cossor ...	415XP	2,000	4	4	1.5
Ediswan	PV425		3	4	.25

SIX-VOLT VALVES: Three-electrode Types

Make.	Type.	Impedance.	Amp. Factor	Fil. Volt.	Fil. Cur.
Mazda ...	RC607	90,000	40	6	.075
Mullard...	PM5B	74,000	37	6	.075
Six-Sixty	6075RC		37	6	.075
Cossor ...	610RC	60,000	50	6	.1
Marconi...	DEH610		40	6	.1
Osram ...	DEH610		40	6	.1
Ediswan	RC610	50,000	40	6	.1
Marconi...	HL610	30,000	30	6	.1
Osram ...	HL610		30	6	.1
Marconi...	LS5B	25,000	20	5.25	.8
Osram ...	LS5B		20	5.25	.8
Ediswan	HF610	21,000	25	6	.1
Mazda ...	HF607	20,000	20	6	.075
Cosmos ...	DE50		9	6	.09
Cossor ...	610HF		20	6	.1
Six-Sixty	6075HF		20	6	.075
Mullard...	PM5X	19,000	17.5	6	.075
Mazda ...	GP607	12,500	14	6	.075
Ediswan	LF610	10,000	15	6	.1
Mullard...	PM6D	9,000	18	6	.1
Cossor ...	610LF	7,500	15	6	.1
Marconi...	DEL610		15	6	.1
Osram ...	DEL610		15	6	.1
Marconi...	LS5	6,000	5	5.25	.8
Osram ...	LS5		5	5.25	.8
Six-Sixty	610P		7.2	6	.1
Mazda ...	LF607	5,300	9	6	.075
Mullard	PM6	5,200	7.1	6	.1
Ediswan	PV610	4,200	5	6	.1
Six-Sixty	625SP	3,600	3.2	6	.25
Cossor ...	610P	3,500	8	6	.1
Marconi...	DEP610		8	6	.1
Mullard...	PM256		3.15	6	.25
Osram ...	DEP610		8	6	.1
Ediswan	PV625	3,000	3	6	.25
Marconi...	LS5A	2,750	2.5	5.25	.8
Osram ...	LS5A		2.5	5.25	.8
Mazda ...	P615	2,600	6	6	.15
Marconi...	P625	2,400	6	6	.25
Osram ...	P625		6	6	.25
Cossor ...	610XP	2,000	5	6	.1
Mullard...	DFA9		5	6	.6
Mazda ...	PX650	1,750	3.5	6	.5
Ediswan	PV625A	1,600	4	6	.25
Marconi...	P625A		3.7	6	.25
Osram ...	P625A		3.7	6	.25

FOUR-ELECTRODE VALVES: Screened-grid

Make.	Type.	Impedance.	Amp. Factor.	Fil. Volt.	Fil. Cur.
Mullard...	PM12	230,000	200	2	.15
Six-Sixty	215SG	220,000	190	2	.15
Cossor ...	220SG		200	2	.2
Marconi...	S215	200,000	170	2	.15
Osram ...	S215		170	2	.15
Ediswan	SG215	140,000	140	2	.15
Mullard...	PM14	230,000	200	4	.075
Six Sixty	4075SG	220,000	190	4	.075
Cossor ...	410SG	200,000	200	4	.1
Ediswan	SG410	115,000	140	4	.1
Marconi...	S625	175,000	110	6	.25
Osram ...	S625		110	6	.25
Ediswan	SG610	100,000	140	6	.1

FIVE-ELECTRODE VALVES: Pentodes

Make.	Type.	Impedance.	Amp. Factor.	Fil. Volt.	Fil. Cur.
Ediswan	5E225	65,000	80	2	.25
Six-Sixty	230PP	64,000	80	2	.3
Mullard...	PM22	62,500	82	2	.3
Marconi...	PT235	55,000	90	2	.35
Osram ...	PT235		90	2	.35
Cossor ...	230QT	20,000	40	2	.3
Mullard...	PM24	28,600	62	4	.15
Six-Sixty	415PP	27,000	60	4	.15
Cossor ...	415 QT	20,000	40	4	.15

MAINS VALVES: Three- and Four-electrode

Make.	Type.	Impedance.	Amp. Factor.	Fil. Volt.	Fil. Cur.
Marconi...	S Point 8	200,000	160	.8	.8
Osram ...	S Point 8		160	.8	.8
Marconi...	H Point 8	55,000	40	.8	.8
Osram ...	H Point 8		40	.8	.8
Marconi...	HL Point 8	17,000	17	.8	.8
Osram ...	HL Point 8		17	.8	.8
Marconi...	P Point 8	6,000	6	.8	.8
Osram ...	P Point 8		6	.8	.8
Marconi...	KH1	30,000	40	3.5	2.0
Osram ...	KH1		40	3.5	2.0
Marconi...	KL1	3,750	7.5	3.5	2.0
Osram ...	KL1		7.5	3.5	2.0
Cossor ...	MRC	80,000	50	4	1.0
Ediswan	MI41RC	50,000	45	4	1.0
Cossor ...	MHF	20,000	20	4	1.0
Cosmos ...	AC/G	17,500	35	4	1.0
Ediswan	MI41	9,000	16	4	1.0
Cossor ...	MLF	8,000	8	4	1.0
Cossor ...	MP	6,500	5.5	4	1.0
Cosmos ...	AC/R	3,000	10	4	1.0
Cossor ...	MXP		3.5	4	1.0

A glance through the constructional articles in this issue will give the novice some hints regarding the best valves for the various types of circuits

A screened grid receiver that SPANS THE EASTERN HEMISPHERE

LISSEN

Show you how to build it IN SIX SIMPLE STEPS

You expected something sensationally good when Lissen announced the new S.G.3 Constructional Receiver ; and now from all sides Lissen are receiving proof that this receiver, built by amateurs in accordance with Lissen's instructions, is indeed the wonder set of the year. Stations have been logged on it as far afield as Moscow, as difficult to separate as Hamburg and Madrid, and these stations are being received, not under "freak" conditions, but night after night just as desired.

How You Can Start at Once

Go to your radio dealer now and ask for the FREE STEP-BY-STEP Chart of the Lissen S.G.3 Receiver ; or post the coupon below direct to the factory. You have not got to buy a complete kit of parts, because Lissen know you probably have many Lissen Components in a previous receiver. You are not tied to any particular make of valve; you choose whatever make you like.

You have not got to buy a cabinet of tin, which as you know is bound to damp the tuning; Lissen suggest that you choose a cabinet of polished wood for yourself from any radio dealers' stock, and so make the finished set a handsome piece of furniture. Lissen have simplified the building of this S.G.3 Receiver by supplying diagrams for each step of the construction. A ready-drilled panel, a baseboard with component layout marked, aluminium screens all ready to erect—all these Lissen have thought out carefully, enclosed in an envelope, price 10s., which also contains wire, term nals, sleeving and all the screws and sundries you require. The building is made more simple by the fact that all standard Lissen parts are used, and you can buy them from any one of

10,000 Radio Dealers

Not only this, but any Lissen dealer will gladly give you help and advice. You can buy the parts all at once or by instalments, just as you like. Get a Lissen S.G.3 Chart at once and take advantage of this latest development of radio.

LISSEN LIMITED
Friars Lane, Richmond, Surrey
(Managing Director: Thos. N. Cole)

COMPLETELY ASSEMBLED RECEIVER as illustrated
£8
(Valves, Batteries, Accumulator and Loudspeaker only excluded)

FREE— Step-by-step Chart and Wiring Diagram

To:
LISSEN LIMITED,
Friars Lane,
Richmond, Surrey

Please send me FREE STEP-BY-STEP CHART of the Lissen S.G.3 Receiver.

NAME----------

ADDRESS----------

CHOOSING YOUR NEW YEAR SET

1929

Suggestions for the Home-constructor

by D. SISSON RELPH

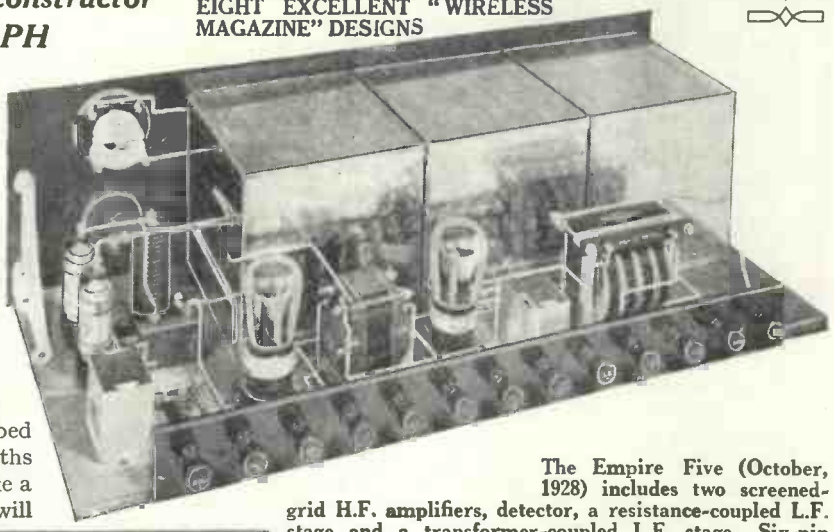
ILLUSTRATED WITH PHOTOGRAPHS OF EIGHT EXCELLENT "WIRELESS MAGAZINE" DESIGNS

AT this season of the year it is timely to think of good resolutions and every reader of the WIRELESS MAGAZINE will want to include at least one wireless resolution.

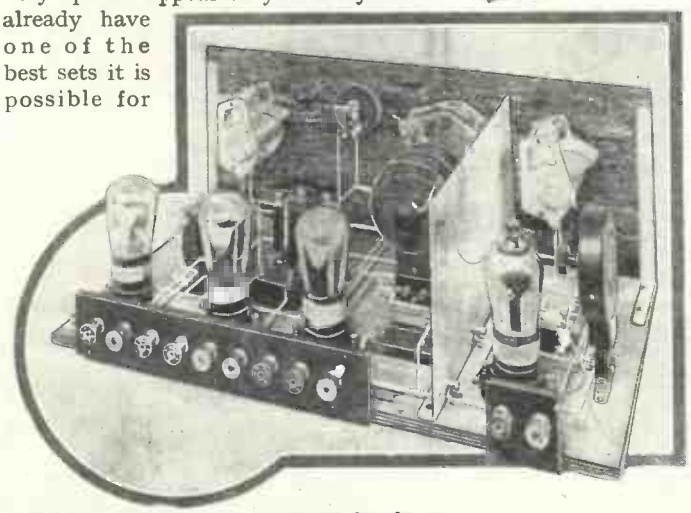
What better resolution can there be for a keen wireless enthusiast than a determination to take advantage of all that is best in recent developments by building a new receiver?

One of the Best Sets

Of course, it may happen that you have built one of the receivers described in these pages during the last few months—in that case this article will not make a very special appeal to you for you will already have one of the best sets it is possible for a home-constructor to obtain.



The Empire Five (October, 1928) includes two screened-grid H.F. amplifiers, detector, a resistance-coupled L.F. stage and a transformer-coupled L.F. stage. Six-pin binocular coils are used



Standard two-pin coils are used in the Economy Screened-grid Four (December, 1928). The circuit is one H.F., detector, one resistance-coupled L.F. amplifier and a transformer-coupled L.F. amplifier

On the other hand, if your set is a year or more old and has not been modified since it was built, I shall be able to put you on the track of better results, both in range and quality of reproduction.

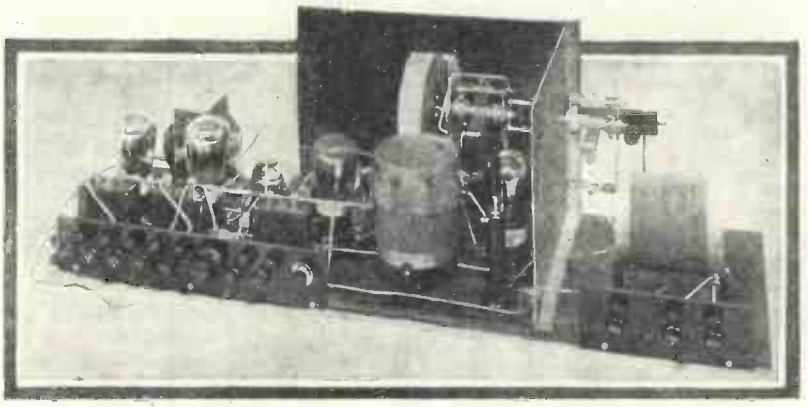
It is quite possible, and indeed most probable, that your first concern will be one of expense. "Ah!" you will exclaim, "I should certainly like a new set, but it will cost me too much."

Well, let us consider the point. If you choose a set simply because it seems to you to be an ideal receiver and in making your choice you disregard the components you already have on hand, then indeed your new outfit will run into a good many pounds.

Discretion in Your New Choice

On the other hand, if your choice is made with discretion—with one eye on the new design you may favour and the other on your old set—you may not have to scrap wholly the gear you now

An ordinary three-electrode H.F. amplifier, detector, a resistance-coupled L.F. stage and a transformer-coupled stage give amazing results in the Touchstone (November, 1928), which is seen below. Special coils are utilised



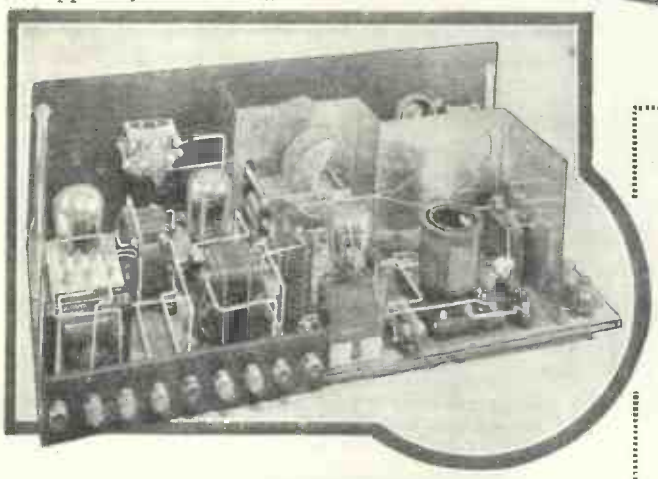
Choosing Your New Year Set *(Continued)*

Receiver portion of the Gramophone Three.

have in your possession, possibly in a set.

Let me make this point quite clear, for I believe that to most of us expense is an important consideration, not that we grudge the money spent on wireless (we most certainly do not, of course), but at the same time we do not want to spend needlessly when we can get just as good results by keeping the money in our pockets.

Suppose your existing set makes use of an old-fashioned commercial tuner which is perhaps tapped to cover various wavelengths ranges. Your new choice is a screened-grid valve set with which it is desirable to use a centre-tapped coil in the aerial circuit in order to obtain a reasonable degree of selectivity.



A one-knob all-wave set, the Furzehill Four (December, 1928) includes a screened-grid H.F. valve, detector, and two transformer-coupled L.F. stages

When You must Scrap Old Components

Obviously you will be unable to use your all-wave tuner in this type of circuit and if you really insist on the screened-grid set you will obviously have to scrap your old tuner.

On the other hand, were you to be satisfied with a set without high-frequency magnification, it is possible that you could use your present tuner with considerable satisfaction and, in order to complete the kit of parts needed, you might have to buy only one resistance coupling unit.

Cost of Converting to S.G. Valves

In the other case, if you do insist on the screened-grid valve set, you may have to expend a great many pounds on all the additional parts. From this I do not wish you necessarily to conclude that it is always an expensive proposition to convert an ordinary set into a screened-grid valve set—such is by no means the case.

With many old

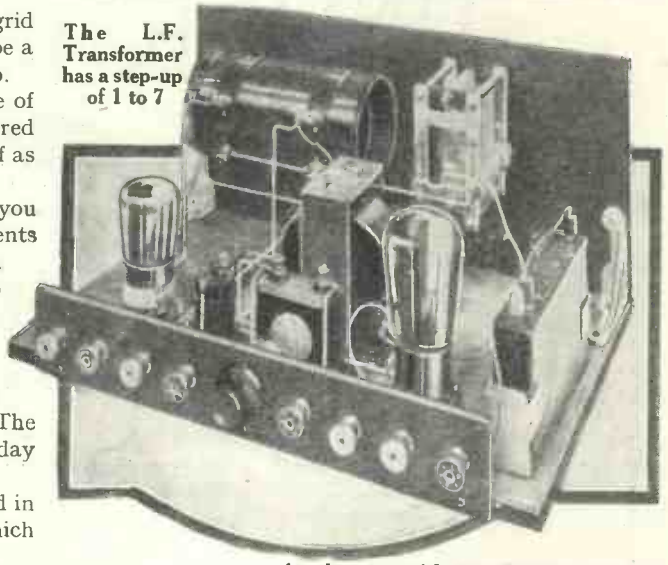
As can be seen, the Gramophone Three (December, 1928), is either a radio set or an electric reproducer. The circuit is a detector and two resistance-coupled stages, and includes an all-wave tuner

Some Suggestions for the Home-Constructor

sets the only additional parts needed for a screened-grid set, apart from the high-frequency valve itself, will be a simple metal screen and a blocking condenser or two.

You will now readily understand that the expense of building a new set can be kept down to almost any desired limit by watching carefully for a design making use of as many as possible of the parts you already have.

Of course, if you have never built a set at all before, you will have to find out the prices of the various components from advertisements. With some sets, you will find the cost of the complete kit advertised by firms who specialise in this branch.



The L.F. Transformer has a step-up of 1 to 7

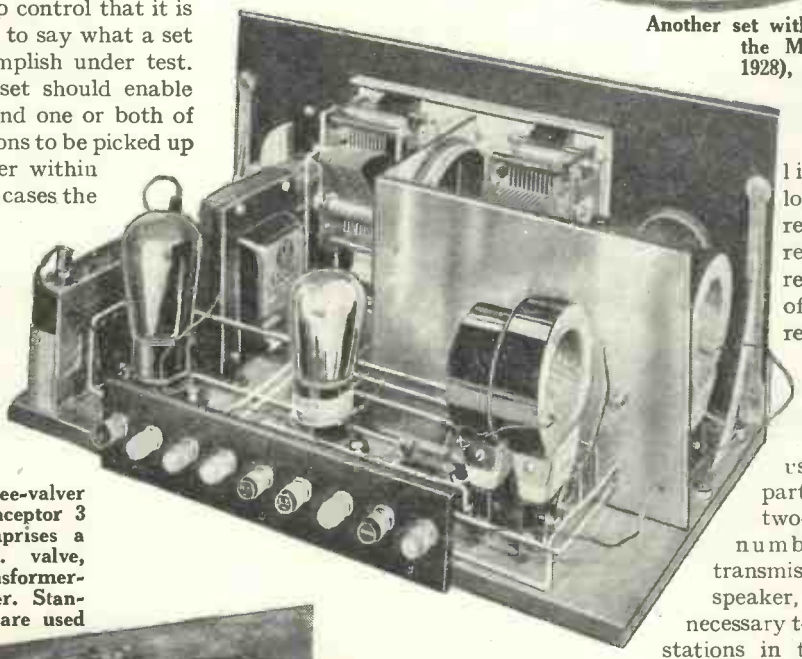
What Designs Are There Available?

Let us now consider in detail what types of set are available and what are their special advantages. The number of valves in a receiver is of less importance to-day than it has ever been in the history of wireless.

So much depends upon the actual components used in conjunction with the valves and conditions over which the designer has no control that it is extremely difficult to say what a set will actually accomplish under test.

Any two-valve set should enable the local station and one or both of the Daventry stations to be picked up on the loud-speaker within 100 miles. In some cases the range will be less and in others very much greater.

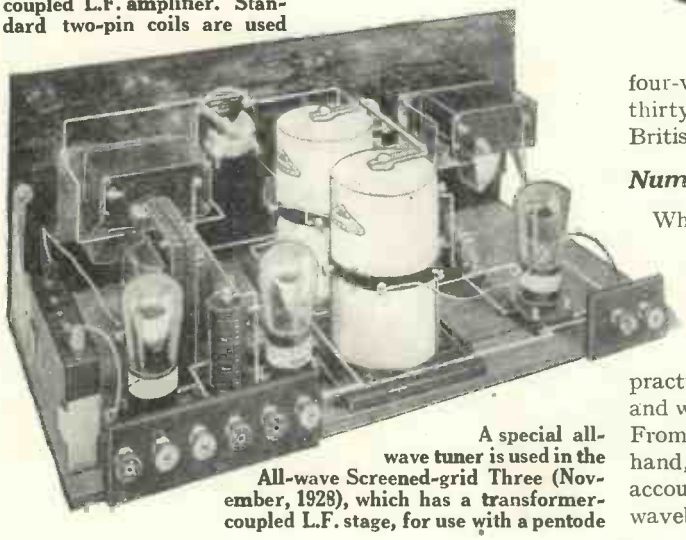
When choosing a set for the first time it is extremely valuable to have the experiences of other listeners in the locality with specified receivers. For this reason the letters from readers giving reports of their receivers which regularly appear in these pages are of great value and should be referred to.



Another set with an all-wave tuner is the Meteor Two (December 1928), which consists of a detector and one transformer-coupled L.F. stage

Although when used in the southern part of the country a two-valver will pick up a number of continental transmissions on a loud-speaker, a three-valver will be necessary to get any continental stations in the north. With a four-valver it should be possible to pick up twenty or thirty stations on the loud-speaker anywhere in the British Isles.

The most popular three-valver of the year, the Inceptor 3 (October, 1928), comprises a screened-grid H.F. valve, detector, and a transformer-coupled L.F. amplifier. Standard two-pin coils are used



A special all-wave tuner is used in the All-wave Screened-grid Three (November, 1928), which has a transformer-coupled L.F. stage, for use with a pentode

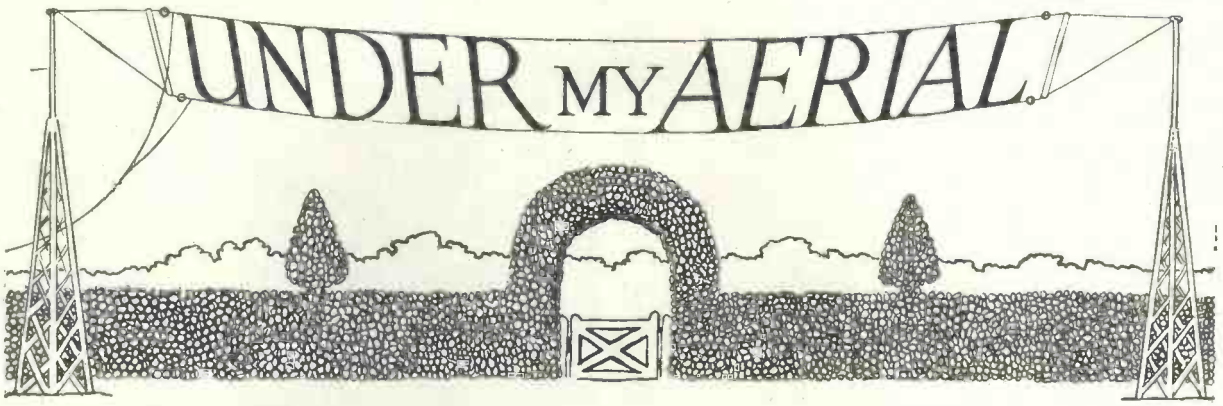
Number of Controls and Wavelength Range

What is more important to the user, than even the number of valves in a set is the number of controls. Indeed, if the receiver is for general family use it is essential to cut down the knobs as much as possible.

Directly linked with the question of control is the wavelength of a receiver. It is the common practice to say that a set using say, three plug-in coils and with only two tuning condensers, is a two-control set. From one point of view that is quite right. On the other hand, if the question of wavelength range is taken into account it will be seen at once that for reception on both wavebands the set has in effect five controls

HALYARD'S Chat on the Month's Topics

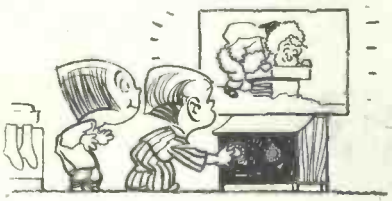
Sketches by GLOSSOP



Christmas, 1928

HELLO! Hallo! Allo! Ah-low! Hallia! Hallooo! Hallabalooo! Achtung! Atençion! Attaboy! Howsyerself! and similar switching-on greetings in the other wireless languages.

Tuned-in all right? A little more grid bias on that last valve, please. Thank you. Off we go, then. *Ici le poste du Halyard. Hier ist Halyard auf umpteen meter. Esta es la estacion Halyard.* In plain English: This is Halyard calling from under his aerial. Same old Halyard as ever



Christmas 1928

was, same old aerial, same old wish, *A Merry Christmas Everybody*, sent out in the same good old spirit of wireless *cameraderie*.

A RIGHT GOOD WIRELESS CHRISTMAS TO YOU ALL!

May your wireless sets perform wonders hitherto unheard during the coming festive season. May your non-wireless friends go as green with envy as the Christmas cheese when they realise what a boon your receiving sets are to you and yours this Christmastide. May the gentleman at the charging station charge your accumulators as he has never charged them before, and may your high-tension supply reach its highest state of excellence this season of festivity. Likewise, all the other good wireless wishes that could be thought of for you all.

This is our fourth WIRELESS MAGAZINE Christmas, you know. Let's make it a better wireless Christmas than any of the preceding three.

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That Extra Bit

You know how it has become the custom with us at Christmas to provide ourselves with a little bit more than usual of all the good things that we enjoy. The signs of the times are that Christmas, 1928, will see this good old custom observed as well as ever.

There will be all those appetising extra bits in the food line. There will be that extra box of cigarettes, and the old tobacco jar will be fuller than it ever has been during the year. There will be new records for the gramophone and there will be a host of other extra good things.

What about that extra bit of wireless you are going to provide for this coming Christmas? Will that extra bit be a new set, a new loud-speaker, a new power valve, or will it be just the usual new dry battery?

Here's an idea for something quite new for that extra bit of wireless equipment you require for Christmas, 1928. You remember the broadcasting map of Europe which appeared in the December, 1926, issue of the WIRELESS MAGAZINE? Well, make a good big copy of that map, paste or pin your copy on a board, and place the map and board in a prominent position near your receiving set.

Then, when you are receiving a Continental broadcasting station for the benefit of your friends during your Christmas reunions, mark the position of that station on your map by means of a large pin, or better, by means of a little flag of the country to which that broadcasting station belongs.

That Extra Bit

Try this little "extra bit" plan, and I am sure it will add a great deal to the interest and delight with which your distant transmissions are received.

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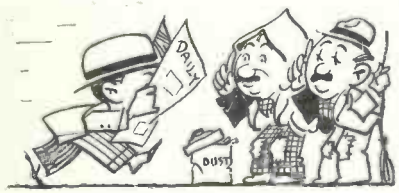
The Present Season

What about your Christmas presents? Getting on with them all right this year? No easy task buying presents for all those to whom you ought to give presents at this time of the year, is it?



The Present Season

Well, I don't want to worry you about *your* Christmas presents just now. Neither do I want to worry about my own. What I would like to do, though, is to discuss with you suggestions for other people's Christmas presents.

Starting with the B.B.C., what do you suggest as a suitable present for the B.B.C. to give to listeners this Christmas? A definite and complete regional scheme? That might do for Christmas, 1930, perhaps. Alternative programmes? Now, that's a good suggestion. Alternative programmes—two, three, four, or even five alternative programmes for us all to choose from—and a huge reduction in simultaneous broadcasting for Christmas, 1928. Excellent idea!

Let me tell you my suggestion. It is that the B.B.C. should give us this Christmas a new first-class wireless humorist. Difficult to find, you say. I know it is, but somebody found John Henry and somebody found Vivian Foster, to mention two of our successful broadcast humourists.

Another suggestion I have to make is that the Union Internationale de Radiophonie at Geneva should give us a Christmas ether clear of heterodyning interference, and all other forms of wireless trouble. What an added joy would be ours this Christmastide if we were never once compelled by wavelength encroachment to turn our condensers away from our favourite broadcasting stations.

The Post Office? Ah! Now what could the Post Office give us this Christmas? Any ideas? I have one: Free telephone encore calls to the nearest B.B.C. station during Christmas week. Christmas is a great time for encores, especially at meal times.

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By Examination

"There seems to be a decided possibility, George, that the B.B.C. will become a Government department, pure and simple, in a few years," I remarked to my wireless consultant last night just after switching-off time.

"Well! What about it?" asked George.

"Members of the B.B.C. staff would then become civil servants, George."

"Well! What about it?" asked George, yawning for the second time.

"Only that the usual way into the civil service is by examination, George."

"In the which case there would be an examination for announcers, would there not?"

"I suppose so, George."

"Rather an idea, that."

"I don't know, George. It seems to me that you could scarcely pick out a good announcer by an examination."

"Depends on the examiner. It could be done by the right man. I should like to try it."

"What questions would you suggest, George, for such an examination?"

"Well, er—er—Question one: Do you know the difference between a microphone and a grand piano?"

"What on earth is that silly question for, George?"

"Well, you don't want the fellow talking into the piano, do you?"

"George——"

"Question two: Who put the first depression over Iceland and why? Question three: Why was Savoy ill? Question four: What can you see in television?"

"But, seriously, George——"

"Question five: Listeners hear no good of themselves. Comment on this statement from the point of view

By Examination

of broadcasting. Question six: Practical test. Go through the correct facial contortions signifying refusal to a silent invitation to go out and have one in the middle of a dry talk."

"Nobody could possibly pass *your* examination, George. Then what would you do?"

"Take the job myself, old man."

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The Year's Best Set

Which do you consider to be the best of our 1928 receiving sets? I wish we could take a really comprehensive vote on the year's sets. Don't you think it would be very interesting to see which sets would get the most votes?

You might try to run a limited vote of the kind amongst your wireless friends. Have you any idea what the result would be?

Personally, if I were asked to give

The Year's Best Set

my opinion as to our best 1928 set, I should ask in what class, for I should have no end of a difficulty in picking out one particular set from the year's many and varied sets. Classify the year's sets according to type and the difficulty is considerably reduced.

First of all, take the class in which a decision is easy—portable sets. There is only one possible set for it in this class, and that is the Chummy Four.

I venture to prophesy that, when our portable sets are taken out in the open again next spring, the Chummy Four will easily outnumber any other type of portable set on the road.

In the one-valve class I have no definite choice. Have you? In the two-valve class I should give an emphatic vote for the Chapman-Reinartz Two, as described in the October numbers of *Amateur Wireless*.

Taking the three-valve class next, I rather think the Inceptor 3 would get the biggest vote, although one of the "screened-grid threes" might run it pretty close. In the four-valve class my suggestion is the Touchstone.

Whatever opinions we may hold as regards the best sets of the year, I think we should all agree that 1928 has been the best year for wireless sets so far.

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1928

What do you consider to be the most outstanding wireless events of the year 1928? A great deal has happened in the world of wireless during the last twelve months, you know.

Perhaps we cannot point to any revolutionary development, such as the invention of the valve, say, but steady progress has been made in many ways during the year, and the end of 1928 finds us in an appreciably better position as regards wireless than that in which the end of 1927 found us.

One of the very biggest developments of the year has been the combination of the wireless receiver with the gramophone to form what is now looked upon as an ideal instrument for entertainment in the home.

The most important development in the valve line has been the introduction of the new four-electrode screened-grid valves, and the five-electrode valves. We have a good deal to learn, though, about these new valves, and the circuits in which they can be used with advantage.

In broadcasting, the event of the year has been the picture transmissions.

Several of my wireless friends consider that our broadcasting programmes have fallen off in quality during the year. I do not agree with

Under My Aerial (Continued)

1928

this view, for I think that the B.B.C. folk more than balance a slight falling off in their general programmes by their special broadcasts, such as that wonderful set of broadcasts on Armistice Day, for example.

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A Resolution

What good wireless resolution are you going to make for the New Year? A resolution I should like to make and carry out is never to have anything to do with other people's old, out-of-date receivers throughout the whole year.

I find it very hard work indeed

A Resolution

trying to think out a scheme for transforming somebody else's three-year-old into a modern receiver, and I wish I could be entirely free from such arduous tasks in 1929. I am certain that I have had more than my share of that kind of work in the year that is now drawing to a close.

Take this last week, for example. I have been concerned in three schemes of wireless renovation, the old set in each case being a four-valve set—tuned anode, detector, two low-frequency amplifying valves, transformer coupled.

The first of these three sets was a large one, the second was larger, and the third—well, the third was a monumental affair—a wireless Stonehenge. I gave what advice I could in each case, but I was very, very careful not to be inveigled into any promises to carry out the suggested scheme of modernisation myself.

Perhaps in the New Year, if I cannot live up to a resolution never to go into consultation over an old set, I might make it a hard-and-fast rule to advise the building of an entirely new set in every case. That would be an easy way out of the difficulty.

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Short Waves

Are you interested in short-wave work? I mean work on the very short waves—below 50 metres, say. During the last few weeks I have spent the bulk of my wireless time on such work, and I could well do with a little helpful advice from somebody who has had more experience of this kind of work than I have had.

I find this short-wave work very fascinating—intensely so—but if I had to describe *my* short-wave work in one word, I think I should use the word erratic.

You see, I have been trying to devise my own coils for my short-wave receiver, and my success has been rather varied. I think I got the idea of trying my hand at short-wave coils from the description of the Girdle Two in the WIRELESS MAGAZINE for September, 1927. This particular short-wave set, by the way, makes an extremely good starting point for anyone desirous of carrying out experiments in short-wave reception.

A year ago short waves were supposed to be the thing of the future. I am inclined to think that short waves are *still* the thing of the future, as far as I am concerned. But I am very hopeful of my future.

Those of us who have taken up this fascinating short-wave work are venturing, I am certain, into one of the most promising fields of wireless. So here's good luck to all the short-wavers for 1929, and may their success increase as their waves decrease.

Short Waves

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The Unexpected

The chief charm about short-wave work, to my mind, is the unexpected results one obtains. On the higher waves you usually know what you are going for, and you usually get what you know you are going to get. On the very short waves it is altogether different. You do not always know what you are going for, and, if you do, the chances are that you will get something very different.

When I started my recent short-wave work with coils of my own design, I had little idea of the wavelength range of my coils. The first

The Unexpected

coils I made gave no results at all, and I became a little despondent. Then, without the least warning, I got hold of PCJ. So pleased was I with my reception on so low a wavelength that I rang up a short-wave enthusiast friend on the telephone and let him listen to PCJ over the line.

PCJ is one of the very best stations as regards the important matter of giving name of station and wavelength. I wish I could speak the three languages: English, French, and German as fluently as PCJ's announcer.

Another of my coils seemed to be a failure until this very afternoon, when I happened to try the coil quite casually and most unexpectedly came across an English station testing on 65 metres. I actually heard the magic word "Writtle" in the speech from this station. If you really want something unusually exciting in wireless reception, try the very short waves, and I am certain you will become as fascinated with short-wave work as I am. HALYARD.

An attractive moving-coil cabinet made by W. T. Lock & Co.

W. JAMES Discloses Some

FAULTS IN COIL-DRIVE LOUD-SPEAKERS

And Explains How to Overcome Them

IN order that we may the more easily consider the problems involved in the design of a coil-driven loud-speaker, let us divide it into three parts and examine each separately. It must be distinctly understood, however, that although we recognise three essential parts, they are dependent one upon the other and that the final result depends upon the excellence with which the parts are blended together. These three parts are :—

1. The magnet system for creating the necessary magnetic field or number of lines of force.
2. The diaphragm or cone assembly. This comprises in present-day reproducers a cone having a coil attached thereto with a means for flexibly suspending the assembly.
3. The baffle.

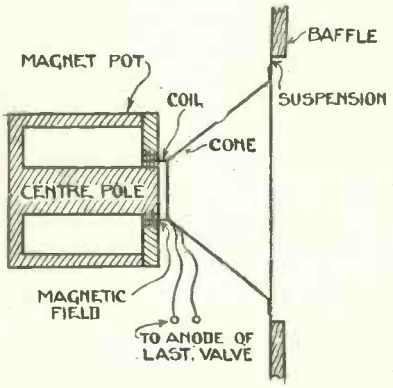


Fig. 1.—Essential parts of a coil-drive reproducer

Principles of Operation

The parts are shown in diagrammatic form in Fig. 1, and the reader will, no doubt, be familiar with the general principles of operation. Briefly, the coil lies in a strong magnetic field and is connected to the anode circuit of the last valve of a receiver, either through a filter feed system or a transformer.

Audio-frequency currents therefore flow through the coil and, because they create a magnetic field which varies according to the strength of the currents, the coil (and diaphragm) is moved backwards and forwards by the forces produced between the fluctuating field due to the coil and the steady one provided by the magnet. This movement sets up sound waves, and the object of a designer is to obtain the maximum of sound for a given strength of current flowing through the coil, with as nearly as possible an even response over the whole range of frequencies.

In practice, uniform response is not obtained. There are various defects with all types of reproducers, no matter how carefully they are built and used. But the object is so to minimise them that the output is reasonably free from faults. It seems that with present-day knowledge perfection is not to be obtained, but a coil-driven loud-speaker may be so constructed that it is as sensitive as a good cone type and capable of giving better quality than any cone type I have tested.

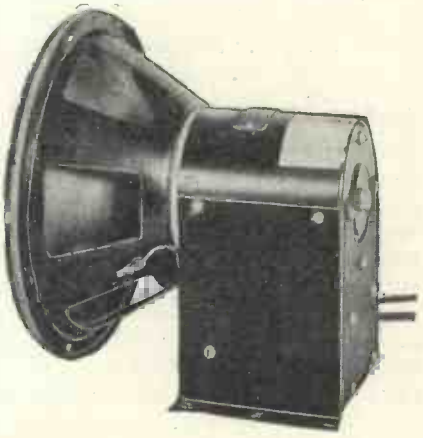
In fact, it is safe to state that a user who has once heard a good moving-coil reproducer will no longer be satisfied with other types.

There are, of course, bad as well as good coil-driven loud-speakers, and it is regrettable that such a proportion of those issued for home-construction should be of poor design. Several of them have glaring faults, mainly due to the failure of those who issued them to understand the essential principles involved, and not to efforts to reduce costs.

Magnet System

Let us deal with the magnet system first. It is well known that for sensitivity a strong magnetic field is required, and experience indicates that a flux density in the air gap of approximately 10,000 lines per square centimetre is desirable. It seems that it is not possible to obtain the necessary field strength from an inexpensive assembly of permanent magnets, and it is, therefore, usual to employ an electromagnet, the current for which may be obtained from an accumulator or other supply of electricity.

Electromagnets are usually arranged as indicated in Fig. 2, where it will be seen that a circular centre pole is employed with a bored end plate to form the air gap. When a current is passed through the winding magnetic lines are set up



Magnavox dynamic loud-speaker

Faults in Coil-drive Loud-speakers *(Continued)*

Marconiphone version of the R.K. loud-speaker

as indicated by the small arrows.

Notice that the whole of the magnetic flux passes through the centre pole and that the density in the end plates is greater at points x (near the centre) than y, because the total cross section of metal is less. Now, if we assume the flux density in the air gap is 10,000 lines per square centimetre, the total flux is obviously 10,000 multiplied by the area of the gap. The area is, of course, the product of the width of the air gap and its mean circumference. But it will be clear, upon referring to Fig. 3, that the *total* number of lines of force is in excess of the useful number passing across the air gap by an amount depending upon the leakage.

Leakage Flux

A leakage flux amounting to 50 per cent. of the useful flux may easily exist, particularly when the metal forming the pole face is practically saturated, as it generally is, even when steel is used.

It is, therefore, necessary so to proportion the magnet that the total number of lines of force is produced (that is useful flux plus leakage), and for a given field current the greatest efficiency will be obtained when the leakage is the minimum and when the greatest proportion of the magnetising force is employed to set up the lines of force across the air gap.

Suitable Material

Now the magnetising force required to magnetise the core depends upon the material of which it is made, its shape, and the flux density. It depends upon the reluctance of the magnetic circuit, which is comparable with the resistance of an electrical circuit. The total reluctance should preferably be only a little greater than that of the air gap, for then practically the whole of the magnetising force is usefully employed.

A suitable material for the magnet is steel, which is much better than the cast iron so often used. This is because a much smaller magnetising force is required to send a given number of magnetic lines of force through a steel circuit as compared with an iron one; a fact illustrated by the curves of Fig. 4, which show, for example, that to produce a flux density of 10,000 lines per square centimetre in cast iron 120 ampere turns per centimetre length of the iron are required, as compared with 10 for cast steel.

Because the flux density in parts of the magnetic circuit may be very low, however, it is generally possible to employ a cast-iron barrel and back plate, as these parts may be so dimensioned that the cross-sectional area is ample.

The size of the centre pole is restricted as to its diameter by the dimensions of the coil, and it is important that it be of steel. The front plate—which, of course, forms the second pole of the magnet—should also be of steel, in order to maintain the efficiency by minimising the leakage flux and, therefore, the number of ampere turns necessary to force the magnetic flux through this portion of the circuit.

It will be obvious that the greatest efficiency will be obtained when the amount of the leakage flux is the minimum. Experiments indicate that an improvement results by shaping the poles. Thus, the centre pole may be shaped as in Fig. 3b and the pole formed by the end plate as in Fig. 30.

Provided the air gap is not too long nor too wide, it is possible to arrange for a flux density of practically 10,000 lines per square centimetre in the air gap with a magnetising current of half an ampere from a 6-volt battery.

When cast iron is used throughout with a narrow air gap the flux density would be less than this amount, even were the magnetising current increased to several amperes in order to strengthen the magnetising force.

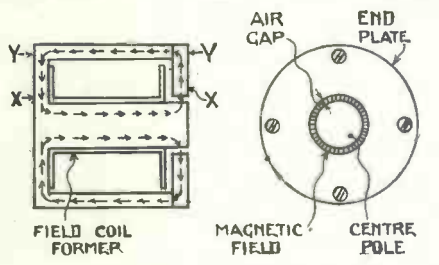


Fig. 2.—Illustrating magnetic field

I have examined a number of published designs where the field current is several amperes, from a 6-volt source, and it is evident that in many instances the large current is necessary because cast iron is used throughout.

The magnet system of a moving-coil loud-speaker may be designed fairly accurately, but the other portions, including the coil, cone, and its support, have to be decided upon mainly by experiment.

Two Types of Coil

Coils are of two types. One comprises a large number of turns of fine wire and the other relatively few turns of stouter wire. Fine-wire coils are usually so proportioned that they may be connected to the output stage of a receiver through an ordinary choke-filter unit. They are wound with wire only two or three thousandths of an inch in thickness and many hundreds of turns are usually employed.

Certain coils have as many as three thousand turns of this fine enamel covered wire, wound on a former two inches in diameter. It is not to be wondered at, therefore, that breakdowns are numerous and when it is remembered that a large air gap must

A Constructive Criticism by W. James

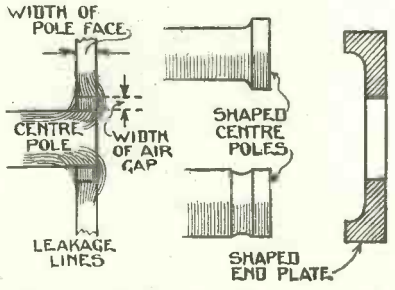
be used to accommodate such a bulky coil, it is not surprising that the tendency is to employ coils of much fewer turns and to adapt them by means of a transformer to suit the impedance of the output stage of the receiver. An argument against employing an output transformer with a large step-down ratio is that, owing to the magnetic leakage effects, the higher musical frequency currents are reduced in strength as compared with those of lower frequency. But this argument is not a good one when the transformer is soundly constructed, and there are available several types which are quite satisfactory. The coil of few turns is a much more reliable construction, and may be used with a narrow air gap.

Bass Weakened

It is further said that when a low-resistance coil is employed with a transformer the lower frequencies may be weakened owing to the relatively low impedance of a transformer at these frequencies. But this is a matter of transformer design and as excellent transformers are marketed there is no need for anxiety on this point.

The coil is fastened to a cone, which is generally of paper. Cones vary in size and shape, but popular sizes seem to be from 6 to 9 inches in diameter with an angle of 90 degrees.

I am not sure that a cone having an angle of 90 degrees is necessarily better than one of 80 degrees or 100 degrees and my experiments indicate an 80 degree cone made from a particular paper has advantages, whilst with another class of paper a 100 degree cone was better. So much depends upon the weight of



Figs. 3a, 3b, and 3c.—Magnetic field round air gap

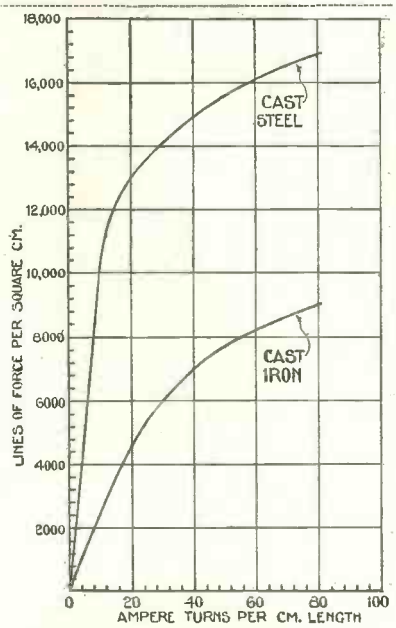


Fig. 4.—Relative magnetisation curves for cast iron and cast steel

the cone and the characteristics of the material that all the experimenter can do is to find the right size for a given quality of paper.

The paper is usually varnished or doped in order that its characteristics shall not change after it has been used for some time, and failure to employ a suitable material may lead to the reproduction becoming harsh and unnatural.

The quality of the reproduction, in fact, depends a good deal upon the stiffness of the paper and different varieties when used with the same size of coil produces vastly different results. It should be noted that the driving force is applied to the coil, which is fastened to the cone. In order, therefore, that the complete assembly may move as one unit, it is essential that the coil and cone be rigidly secured, but in practical examples it seems that complete rigidity is not obtained, with the result that the coil and cone do not behave as one unit moving backwards and forwards under the influence of the forces.

Undesirable resonance effects are therefore present and the object of a designer or experimenter should be to minimise them.

The cone with its coil attached has to be suspended in such a manner that it is quite free to move backwards and forwards. Sideways movement is not desirable. As a rule, the outer end of the cone is flexibly mounted to a support by means of leather, oiled silk, or rubber and a centring device, attached approximately to the point where the coil is fastened to the cone, may be used.

When the air gap is narrow it is almost essential to fit a centring device; but the mistake should not be made of so suspending the cone that it is not free to move over a distance of about one tenth of an inch.

Undesirable Resonance

Undesirable resonances may be the result of the suspension. Many reproducers show this defect from forty to one hundred cycles, according to the construction. Too great a freedom of movement cannot be permitted when the air gap is narrow and the clearance of the coil is small, but it is important that the natural frequency be made so low that it is not harmful.

In many coil-driven loud-speakers there is a point in the low-frequency range and another in the high-frequency range where the sound output is excessively great in comparison with the rest of the frequency scale, but provided these points are at the extreme end of the frequency range they are not troublesome.

The number of turns in the coil, the strength of the magnetic field, and the construction of the cone and its support are the factors which together determine the resonant frequencies. Resonances are obviously undesirable. Notes of the resonant frequency sound too loud and continue to sound after the current in the coil has stopped.

Blurred Sounds

Further : notes approximating to the resonant frequency sound blurred and the quality of the reproduction is impaired.

Loose wires, terminals, or screws, should also be avoided as they rattle or buzz and so spoil the quality.

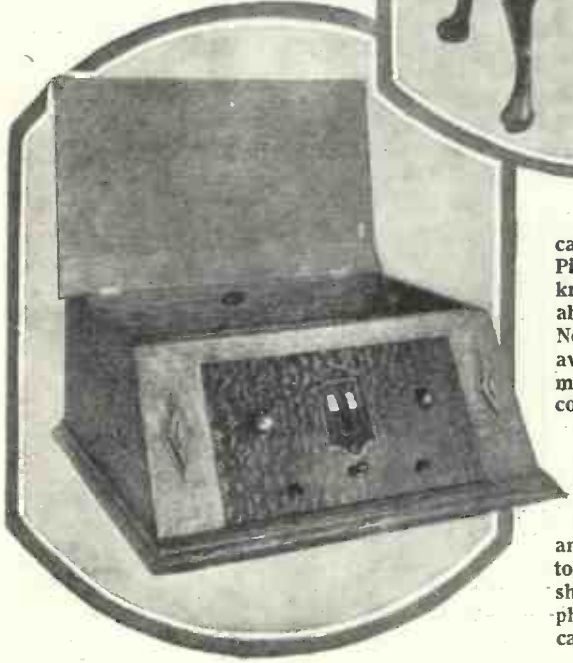
Everyone knows that unless a baffle be used the strength of the low tones is impaired. A baffle in the form of a box is often used as it may also act as a container for the reproducer.

Fine Cabinets for a Fine Set!

(SEE OPPOSITE PAGE)

On this page are illustrated two types of cabinet for the Binowave Four (fully described in the article which begins on the opposite page), specially made for the "Wireless Magazine" by Pickett Bros., of Bexleyheath. The photographs show clearly how attractive is the sloping panel used and how simple is the control of the receiver. Simultaneous tuning of the aerial and anode circuits is obtained by using a Cyldon Synchratune condenser.

Above and in the bottom left-hand corner are two views of a small cabinet for the Binowave Four; this is supplied in various finishes, from 35s. If a cabinet without a wood surround to the panel is chosen, the price will of course be less. The panel slopes at an angle of 60 degrees to facilitate tuning the special condenser dials. Note that the on-off switch can be placed on the panel or on the terminal strip.



An adapted Radiola cabinet—for which Picketts are so well known—is illustrated above and on the right. Notice the large space available for accommodating a moving-coil loud-speaker, mains supply unit, dry batteries or accumulator.

Another interesting point is that either an oval vignette (see top left-hand corner) or shaped end-pieces (see photograph on right) can be fitted.

W. James, our Research Consultant, has for some time been developing a special type of all-wave coil suitable for use with screened-grid valves. These coils are of the binocular type and cover a wavelength band of 200 to 580 and 900 to 2,000 metres. They have been given the name of Binowave (Binocular All-wave) and a patent has been applied for.

THE BINOWAVE FOUR

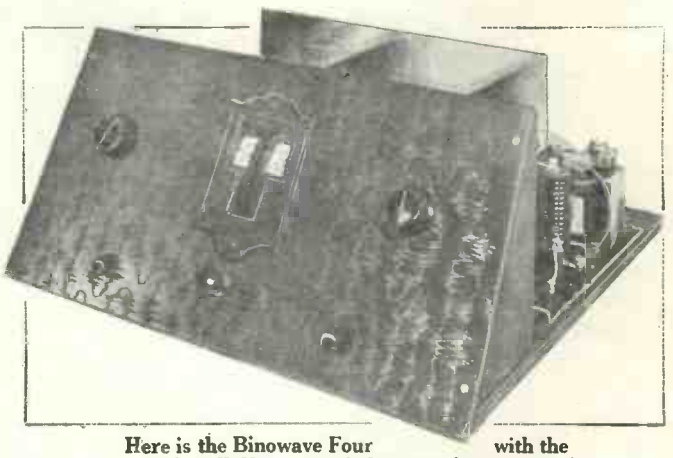
A SCREENED-GRID VALVE SET DESIGNED BY W. JAMES

COVERS BOTH WAVEBANDS WITHOUT COIL CHANGING

PRACTICALLY ONE-KNOB CONTROL WITH THE ADVANTAGE OF INDIVIDUAL ADJUSTMENT

COMPRISES H.F., DETECTOR AND TWO L.F. STAGES

A COMPANION TO THE FAMOUS TOUCHSTONE FOUR



Here is the Binowave Four with the push-pull filament switch on the front panel

THE Touchstone four-valve receiver which I described in the November and December issues is a standard set and I feel sure it will be just as popular with a certain class of amateur in twelve months time as it is to-day. This is because of the number of advanced features embodied in its design, amongst which may be mentioned the single-knob tuning, the great high-frequency amplification and the arrangement of the detector circuit.

I therefore feel that, whilst it will be possible to build slightly different arrangements employing the Touchstone coils, it will not be possible to make fundamental changes to the circuit for a long time to come.

TEST REPORT OF THE BINOWAVE FOUR

All these stations were received in one evening *at full loud-speaker strength.* Weak stations were not logged and the wavelength readings are those obtained with a buzzer wavemeter. It was not, of course, possible to identify absolutely every station, but wherever a station is indicated it can be taken that loud signals were heard on that particular wavelength. Tests were carried out ten miles from London. Thirty-four Stations were logged, as below :—

SHORT WAVES

Station	*Wavelength*	*Dial Reading*
Budapest	555	160
Milan	544	156
Munich	534	152
Vienna	517	148
Brussels	508	144
Daventry 5GB	492	140
Lyons ?	480	135
Langenburg	468	130
Oslo ?	462	128
Rome	449	124
Frankfurt	429	118
Kattowitz ?	420	114
Glasgow ?	405	110
Cork	401	108
Hamburg	396	106
Stuttgart	380	102
Leipzig?	366	98
London	361	95
Barcelona	345	89
Gleiwitz ?	330	84
Bournemouth	326	82
Breslau	322	81
Dublin	319	80
Toulouse	307	77
Koenigsberg	300	74
Cologne	283	65
Nurnberg	242	45

LONG WAVES

Station	*Wavelength*	*Dial Reading*
Huizen ?	1,850	158
Radio Paris	1,765	150
Konigswusterhausen ?	1,649	137
Daventry 5XX	1,562	125
Motala	1,363	104
Konigswusterhausen	1,250	90
Hilversum	1,071	70

It is an easy matter, of course, to build a receiver including the first three stages of the Touchstone with slight modifications in order that loud-speaker signals may be obtained from the more powerful stations, or to include a push-pull amplifier for providing signals of exceptional volume and there may be amateurs who desire one of these alternatives.

Improving the Strength

The variations are easily effected when the Touchstone four-valve set is available as a standard, but I find there is a second class of amateurs who desire to receive stations working on both wavelength bands and who do not mind using a little reaction in order to improve the strength of the more distant stations.

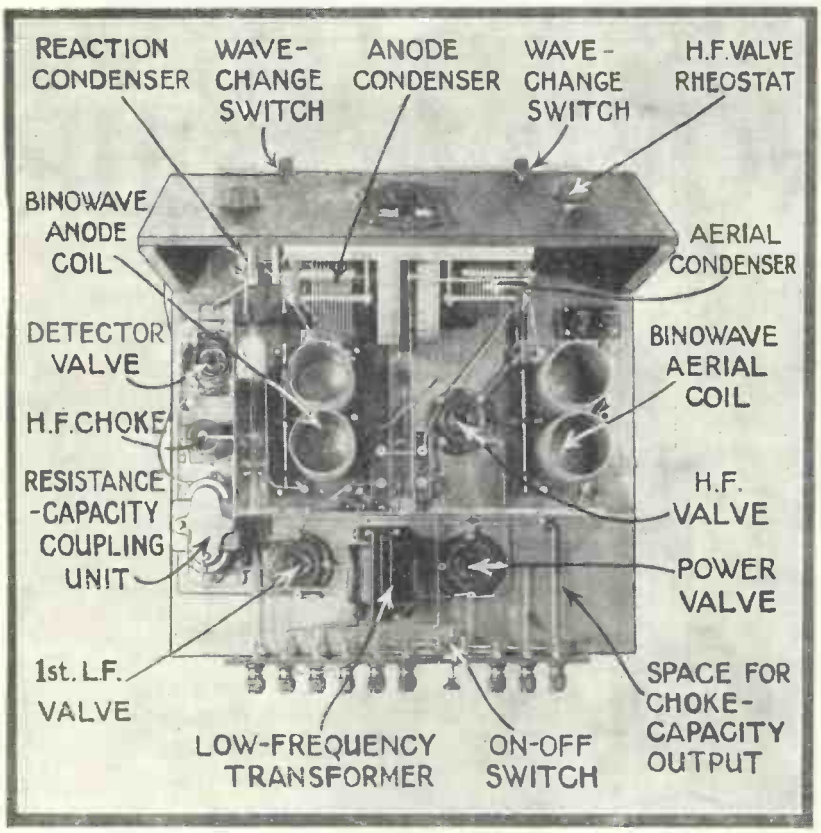
It is for the second type of amateur that the receiver illustrated here has been developed.

This receiver, the Binowave Four is, therefore, not competitive with the Touchstone. It uses the comparatively new shielded valve, for which special coils for tuning over the medium and longer wavelengths have been developed.

Essential Features

The essential features of this receiver will be grasped on referring to the circuit diagram. In the aerial circuit is included a binocular coil having a switch for short-circuiting the fine-wire long-wave windings. The aerial is connected either direct or through a .0001-microfarad fixed condenser to the centre point of the

The Binowave Four (Continued)



This plan view of the Binowave Four clearly shows the arrangement of all the parts

coils, in order to provide a reasonably sharply tuned aerial circuit.

Tuning is, of course, sharper when the fixed condenser is included in the aerial circuit and, further, the two dials of the tuning condensers read approximately the same.

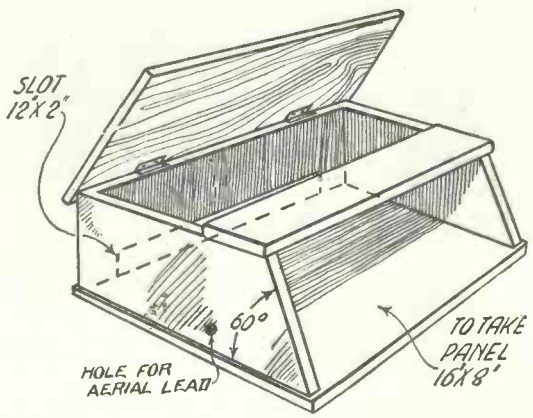
The aerial coil, which is tuned with a .0005-microfarad variable condenser, is connected between the grid of the first valve and the negative terminal of the low-tension battery. Now, an adjustable resistance is joined between the negative side of the battery and the filament, with the result there is a fall in voltage across the resistance.

Negative Bias

The amount of the fall in voltage depends upon the setting of the resistance and, normally, when a 2-volt valve is employed in the first position, there will be a voltage drop of .2 or .3 volt. From the connections it will be seen that the grid of the valve is biased negatively by this amount and, although this resistance is primarily employed as a volume control, I consider this feature of first importance.

It seems to me that a high-frequency amplifying valve must have a small negative grid bias, for otherwise strong signals would produce grid currents and therefore broaden the tuning.

From the manner in which this portion of the circuit is arranged, it should, therefore, be clear that when receiving relatively strong signals, or when troubled with an interfering signal, the filament resistance should be turned a little towards its "off" position in order to increase the negative grid bias. The function of the resistance is primarily for controlling volume, but it is also of great assistance in varying selectivity.



Details of suggested cabinet for the Binowave Four

High-frequency Stopper

To the shield of the screened-grid valve is connected a 600-ohm resistance and a 1-microfarad fixed condenser. It will be noticed that this condenser is joined directly from the shield-grid terminal of the valve holder to the negative filament terminal.

High-frequency currents which may flow in the shield circuits are, therefore, provided with a direct return path to the filaments. The fixed resistance is employed in order to help divert the high-frequency currents to the filament and it still further minimises the chances of the currents passing through the high-tension battery, where they might enter other circuits and tend to produce instability.

Anode Circuit

A Binowave coil, built like the aerial coil, but with the addition of a reaction winding, is included in the anode circuit. The anode of the valve is joined to the centre of the coils, with the result there is a step-up in voltage to the grid of the detector valve and an improvement in the general selectivity, since the anode circuit of the H.F. valve is connected across only half of the coil.

Advantages

The reasons for employing a centre-tapped coil have been explained in an earlier article and with present-day shielded-grid valves the advantage of using this connection is a very real one. **I wish to emphasise the fact that a shielded valve when used with quite ordinary coils in the grid and anode circuits will oscillate even when the two**

A New Screened-grid Valve Set by W. James

circuits are screened from one another.

This is because there is a coupling between the anode and the grid, and, small as it is, it is sufficient to pass so much current from the anode to the grid circuit as to cause the circuits to oscillate. By connecting only half the anode coil to the H.F. valve the voltage fluctuations of the anode as compared with the grid are reduced and there is a corresponding reduction in the tendency for the circuits to oscillate. The improvement is most marked on the shorter wavelength band.

An Improved Design

It would, of course, be possible to stabilise the circuits by introducing losses in the coils or by allowing grid current to flow in the H.F. valve. But these expedients may be all very well for a manufacturer, for example, who desires simplicity more than anything else; they would not meet with the approval of the amateur constructor who naturally desires to produce a set which is a little better than the standard product of manufacturers.

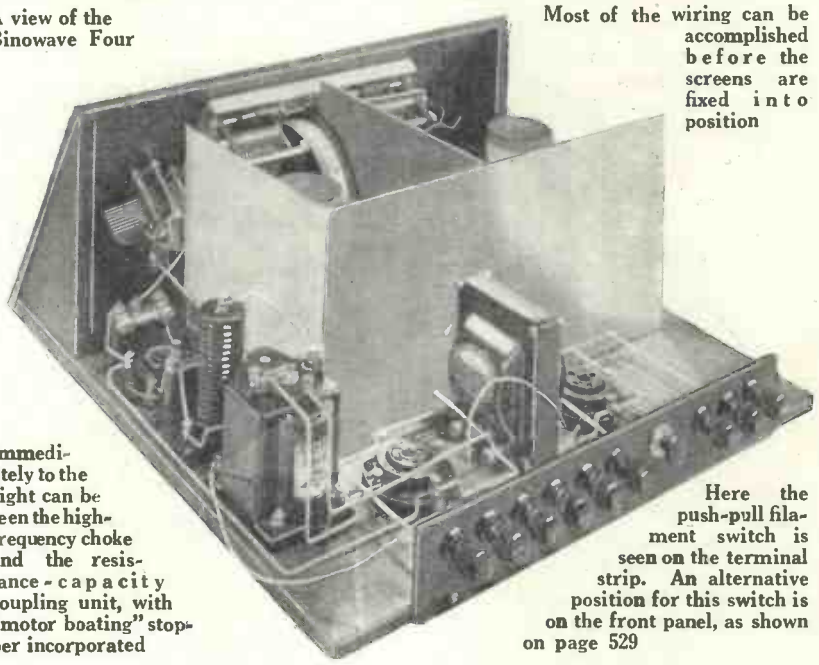
Metal Screening

From the illustrations you will notice that a metal screen is employed between the aerial and anode coils. Further: the screen is continued at the back of the receiver for the purpose of isolating the high-frequency from the low-frequency circuits.

The front panel of the set was arranged to be attractive as well as effective and for these reasons it is inclined at an angle of 60 degrees to the baseboard. This construction of the front panel made necessary the particular arrangement of the components on the baseboard.

The detector valve and high-frequency choking coil are separated by the screen from the anode coil, as I have found that instability may result when there is coupling between the choking coil and the anode circuit, or when the detector valve itself is too near the tuning circuits. It will be realised that the anode of the detector valve varies in voltage at high frequency and therefore it is necessary to confine its field of influence.

A view of the Binowave Four



Most of the wiring can be accomplished before the screens are fixed into position

Immediately to the right can be seen the high-frequency choke and the resistance-capacity coupling unit, with "motor boating" stopper incorporated

Here the push-pull filament switch is seen on the terminal strip. An alternative position for this switch is on the front panel, as shown on page 529

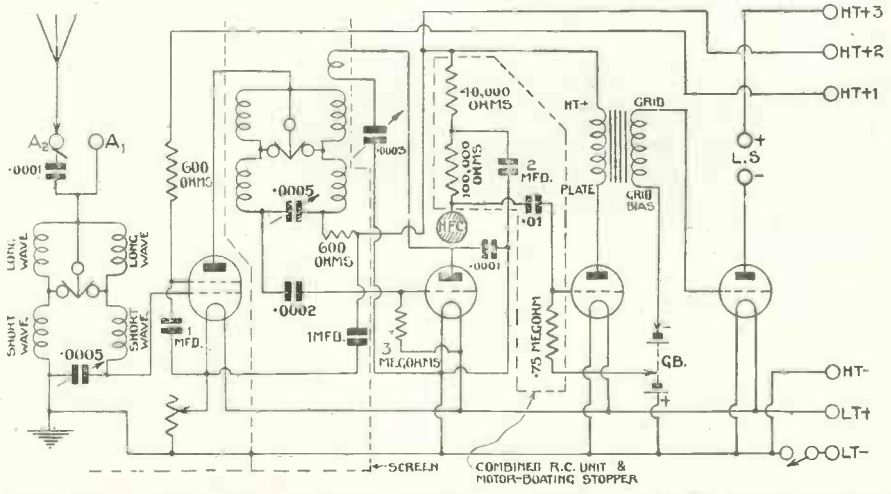
Two Tuned Circuits

The complete high-frequency amplifier, which is often considered, and rightly so, the most important part of a receiver, therefore, comprises two tuned circuits fitted with switches of which the knobs project through the front panel. The switches are part of the coils and do not have to be made by the home constructor.

Use of H.F. Rheostat

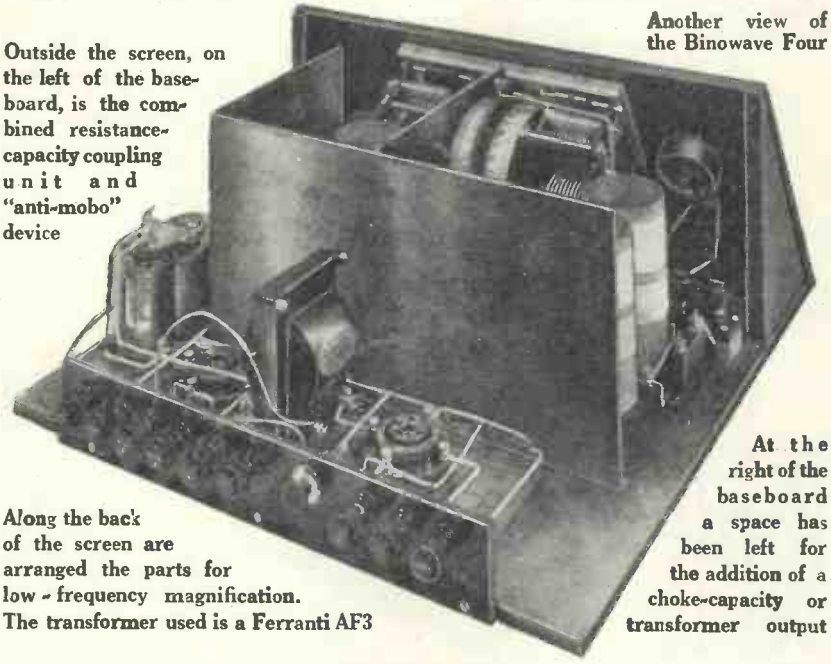
High-frequency amplification and selectivity can be varied with the filament rheostat connected to the shielded valve. The amplification can be controlled in this manner because, as the filament of the valve is dimmed, its impedance increases and, therefore, a greater proportion of the high-frequency voltages are developed across the valve itself.

When the maximum amount of amplification is required the filament resistance should be



This is the circuit of the Binowave Four, which comprises a screened-grid valve, detector with reaction, a stage of resistance-capacity amplification and a transformer-coupled stage

The Binowave Four (Continued)



Another view of the Binowave Four

Outside the screen, on the left of the baseboard, is the combined resistance-capacity coupling unit and "anti-mobo" device

At the right of the baseboard a space has been left for the addition of a choke-capacity or transformer output

Along the back of the screen are arranged the parts for low-frequency magnification. The transformer used is a Ferranti AF3

turned practically full on, as then the greatest current will flow through the filament and the valve will have its lowest impedance for the particular high-tension voltage employed.

The selectivity is varied when the filament resistance is turned because the anode impedance of the valve changes and, as has been explained already, the grid of the valve receives its bias from this resistance.

Perfect Stability

There is no self-oscillation even though the aerial circuit is lightly damped, and the circuit is stable over the whole wavelength range. Good quality of reproduction cannot be expected unless the circuits are perfectly stable and one of the objects when arranging this receiver was to achieve absolute stability.

I suppose those who have read my articles describing the Touchstone will be wondering why solid-wire coils are used in the present receiver instead of coils wound with Litz wire. The explanation is a simple one: for a certain diameter of coil there is a particular ratio of length to diameter and a certain type of wire which will give the finest results. We could not employ very bulky coils in a set such as the Binowave Four and in order to make effective use of Litzendraht we should have to employ very large coils.

These would be so large as to be impracticable, and there is also the effect of the long-wave windings to be considered. The Binowave coils are efficient for their size and are well suited to screened-grid valves. Much more bulky coils, that would be a little more efficient, could be made, but shielding difficulties would crop up and spoil them.

Front of the Binowave Four

This view shows the set without the push-pull filament switch on the panel (compare with photograph on page 529)

In circuits of the Touchstone type the neutralising condenser takes care of small stray couplings, but when using a shielded valve we have to arrange the coils themselves and their circuits in order to secure stable working.

Simplification

With the shielded valve a simplification is possible, but it is paid for by reduced magnification and selectivity. On the other hand the coils are not very expensive, the magnification is sufficient for most purposes, especially when a little reaction is used, and it is easy to arrange switching from one wavelength band to another.

To follow the high-frequency amplifier we employ a leaky-grid detector, which is resistance coupled to the first low-frequency amplifier. As space is a consideration, a combination anode coupling unit was included in the receiver. This comprises an anode resistance, coupling condenser and grid leak, and also an anti-motor-boating resistance and condenser.

Coupling Values

All these parts are included in the one instrument and, as their values are quite suitable, there would be no advantage in employing separate components. Those who happen to have various parts on hand may care to use a 100,000-ohm anode resistance, .01-microfarad coupling condenser and 1-megohm grid leak. In the filter circuit use a 40,000-ohm resistance and a 2-microfarad condenser.

A leaky-grid detector is well known to be more sensitive to weak signals than a detector of the anode-bend type, but it is important that the leaky-grid type be not overloaded when good quality is desired. The grid condenser, it will be noted, has a reasonably small capacity and the effective resistance between the grid and the filament is made sufficiently low for good quality by connecting the grid leak to the positive side of the filament.

Leaky-grid Detector

I prefer a leaky-grid detector when

Wavelength Ranges of 200-580 and 900-2,000 Metres

reaction is being used, as it is easier to obtain a smooth control. Further, although the effect of a badly adjusted leaky grid is to weaken the higher notes, the anode circuit may be so designed that there is only a slight falling off, and as a result the net effect is sensitivity combined with reasonably good quality.

First L.F. Valve

By employing a valve of moderate impedance in the first L.F. position the transformer stage will have a rising characteristic which will tend to compensate for any reduction in the higher frequencies due to the arrangement of the other parts of the circuit.

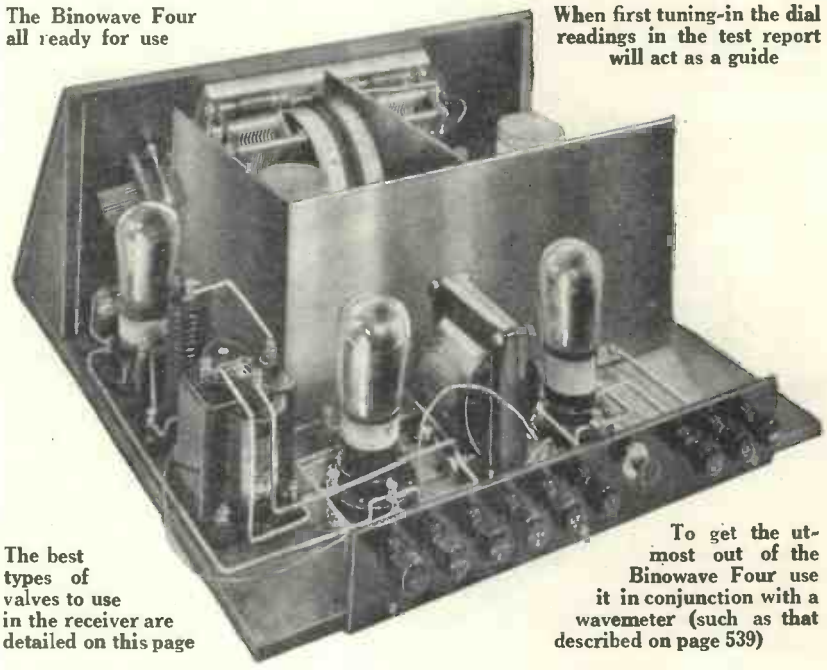
I have, however, not found any great improvement to result by employing a valve of moderate impedance in the L.F. position, because there are quite sufficient high notes in the reproduction when a valve of 15,000 or 20,000 ohms impedance is used.

Resistance Stage

The resistance stage is so proportioned that a reasonable percentage of the total possible magnification is obtained. The anode resistance has a value of 100,000 ohms, and a normal valve of the resistance-capacity type would have an anode impedance of 50,000 ohms, from which it follows that two-thirds of the full amount is secured. When the valve has a magnification factor of 40 the actual magnification of the stage is 27. A better valve would have a magnification factor of 50, when the actual amplification would be over 30.

The amplification of a high audible frequency will naturally be a little lower because of the effect of the by-pass condensers. Two of them are included in the circuit. One has a fixed value of .0001 microfarad and the second is the adjustable .0003-microfarad reaction condenser. The values have been so chosen, however, that the higher frequencies are not noticeably reduced.

The Binowave Four all ready for use



When first tuning-in the dial readings in the test report will act as a guide

The best types of valves to use in the receiver are detailed on this page

To get the utmost out of the Binowave Four use it in conjunction with a wavemeter (such as that described on page 539)

Amplification of 70

A valve having an impedance of approximately 20,000 ohms is recommended for the first low-frequency amplifying stage. Such valves are the Cossor 610HF or the 210LF. When the valve has a magnification factor of 20 the amplification will be approximately 70 and the total low-frequency magnification will be of the order of 2,000 from the detector to the power valve.

This is ample for providing loud-speaker reproduction from weak signals applied to the detector.

It must be understood that it is not safe to calculate the low-frequency magnification unless it is known that the low-frequency circuits are not coupled through a common impedance.

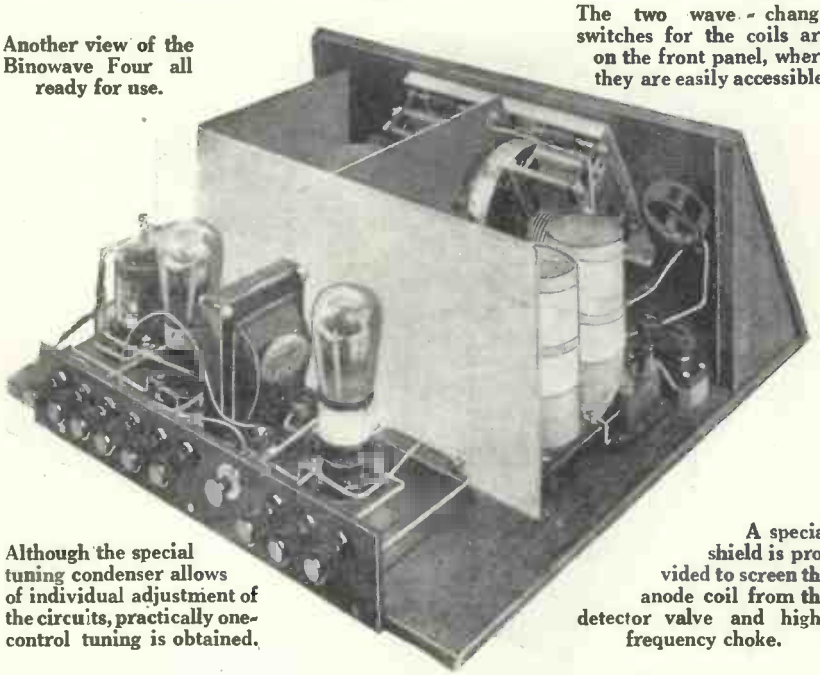
Preventing L.F. Distortion

In this receiver an anti-coupling filter circuit is included in series with the detector, and this will prevent the worst form of low-frequency distortion. There is still the possibility of trouble between the power valve and the first low-frequency stage, but motor-boating as it is generally

LIST OF COMPONENTS FOR THE BINOWAVE FOUR

1—Ebonite panel, 16 in. by 8 in. (Ebonart moiré, Becol, or Parfait).
1—Twin .0005-microfarad variable condenser (Cyldon Synchratune).
1—.0003-microfarad variable condenser (Cyldon Bébé).
1—12-ohm panel rheostat (Gecophone, Lissen, or Peerless).
1—Pair Binowave coils (Wearite, R.I. and Varley, or Finston).
4—Anti-microphonic valve holders (W.B., Lotus, or Formo).
2—1-microfarad fixed condensers (T.C.C., Dubilier, or Lissen).
2—.0001-microfarad fixed condensers (T.C.C., Dubilier, or Mullard).
1—.0002-microfarad fixed condenser with grid leak clips (T.C.C. type SP).
1—High-frequency choke (Lewcos).
1—Combined resistance-coupling unit with anti-mobo device (R.I. and Varley, type Y).
2—600-ohm resistances (Wearite).
1—3-megohm grid leak (Dubilier).
1—Low-frequency transformer (Ferranti AF3, Igranic, or R.I. and Varley).
1—Push-pull on-off switch (Bulgin or Lotus).
2—Terminal strips, 2 in. by 1 in. and 12 in. by 2 in. (Ebonart, Becol, or Parfait).
11—Terminals, marked: A1, A2, L.T.+, L.T.−, H.T.+1, H.T.+2, H.T.+3, H.T.−, L.S.+, L.S.−, Earth (Belling-Lee or Eelex).
1—Aluminium or copper screen (Ready Radio, Magnum, or Parex).
1—Cabinet with 16-in. baseboard (Pickett Bros.).

The Binowave Four (Continued)



Another view of the Binowave Four all ready for use.

The two wave-change switches for the coils are on the front panel, where they are easily accessible.

Although the special tuning condenser allows of individual adjustment of the circuits, practically one-control tuning is obtained.

A special shield is provided to screen the anode coil from the detector valve and high-frequency choke.

known is not likely at all to occur.

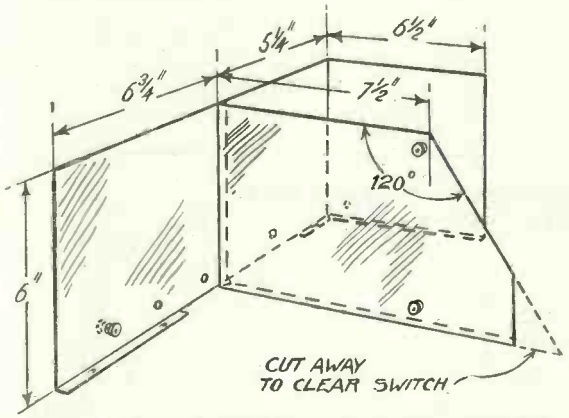
The magnification provided by the high-frequency stage is difficult to determine for the reason that we are dealing with a valve which is not a true one-way amplifier. When measuring the high-frequency amplification given by a Touchstone stage the balancing condenser may be so adjusted that the amount of feed-back to the grid circuit is so small as to be negligible, but there is no comparable method of preventing feed-back when a shielded valve is used. One so designs the stage as a whole that the aerial circuit does not oscillate.

Actual Results

We are therefore in the position of being able to make it appear that the high-frequency amplification is very great, whilst the effective magnification of the whole stage is not so great. This point will be understood when I say that by adding resistance to the aerial coil the amount of anode-circuit magnification which can be obtained without oscillation can be increased. A magnification of 100 could be obtained, for example, by using a very high-resistance coil in the aerial circuit.

There is no practical advantage in doing this, however, and when the same type of coil is used in the anode and aerial circuits the amount of magnification that may be obtained with stability is limited.

With single-coil circuits of the type used in the Binowave Four the amount of high-frequency amplification may properly be considered as rather too much for the degree of selectivity. **In other words, the receiver provides sufficient magnification for the reception of distant stations, and whether or not they are received is more often decided by the selectivity of the set.**



Above are shown details of the metal screen needed for the Binowave Four. This can be obtained all ready cut to size from the firms mentioned in the list of components on page 533

From the list of stations which were received with an outdoor aerial at a place ten miles from the London station it will be understood that the selectivity is good.

Easy Construction

To build the receiver no difficult constructional work is demanded. The two tuning condensers are mounted on the panel with the assistance of the template provided by the makers. Below the ornamental front of the condenser a push-pull filament switch is included, but in the set illustrated this was not wired, as it was much easier to fit and wire a filament switch on the terminal strip. The switch was fitted to the front panel, as it was thought a proportion of readers might care to have it there, and they will be able to wire it in the circuit.

There are two other knobs, that on the left being for the filament rheostat and the one on the right for the reaction condenser.

Two Coil Switches

The two smaller knobs are attached to the coil switches; the switches are actually fitted to the bases of the coils, and extension pieces are provided in order that they may be actuated from the front panel.

When the parts have been assembled on the front panel, two wooden side pieces should be fitted in order to secure the panel at an angle of 60 degrees with the baseboard. Then fit the screen and find the correct positions for the tuning coils. These must be properly mounted in order that the switch spindles be not twisted.

Screen Removed

The remainder of the apparatus is best assembled with the screen removed; this part of the receiver is straightforward.

When everything has been assembled the wiring may be started, but it should be carried out in a logical manner. Upon referring to the blueprint you will see the

A Companion to the Famous Touchstone Four

various wires are numbered, and it is recommended that the wiring be commenced by fitting wire No. 1. The wires from No. 3 to No. 30 can be connected with the screen removed. Only a few wires actually pass through the screen, and these are easily fitted. It is always advisable not to hurry the wiring. Do not attempt to wire the set in an hour or two, as it cannot be accomplished. Each wire should be covered with Systoflex, when Glazite is not used.

Condenser Wiring

There are one or two rather difficult wires to the tuning condenser, but they can easily be fitted when the reaction condenser is rotated a little from its normal position.

There are three flexible wires for grid bias, and these should be left of sufficient length to reach a grid-bias battery fastened to the back of the cabinet a little above the terminal strip. The grid battery may be held by a pair of small clips screwed to the inside of the back panel.

Output Circuit

It is recommended that a super-power valve be used in the output position and room has been left for an output transformer or filter circuit to be fitted by the side of the output valve when one is necessary.

In the high-frequency stage fit a shielded valve and connect the flexible wire to the anode. Fit a valve of the R.C. type in the detector position and a valve having an impedance of approximately 20,000 ohms in the first L.F. stage.

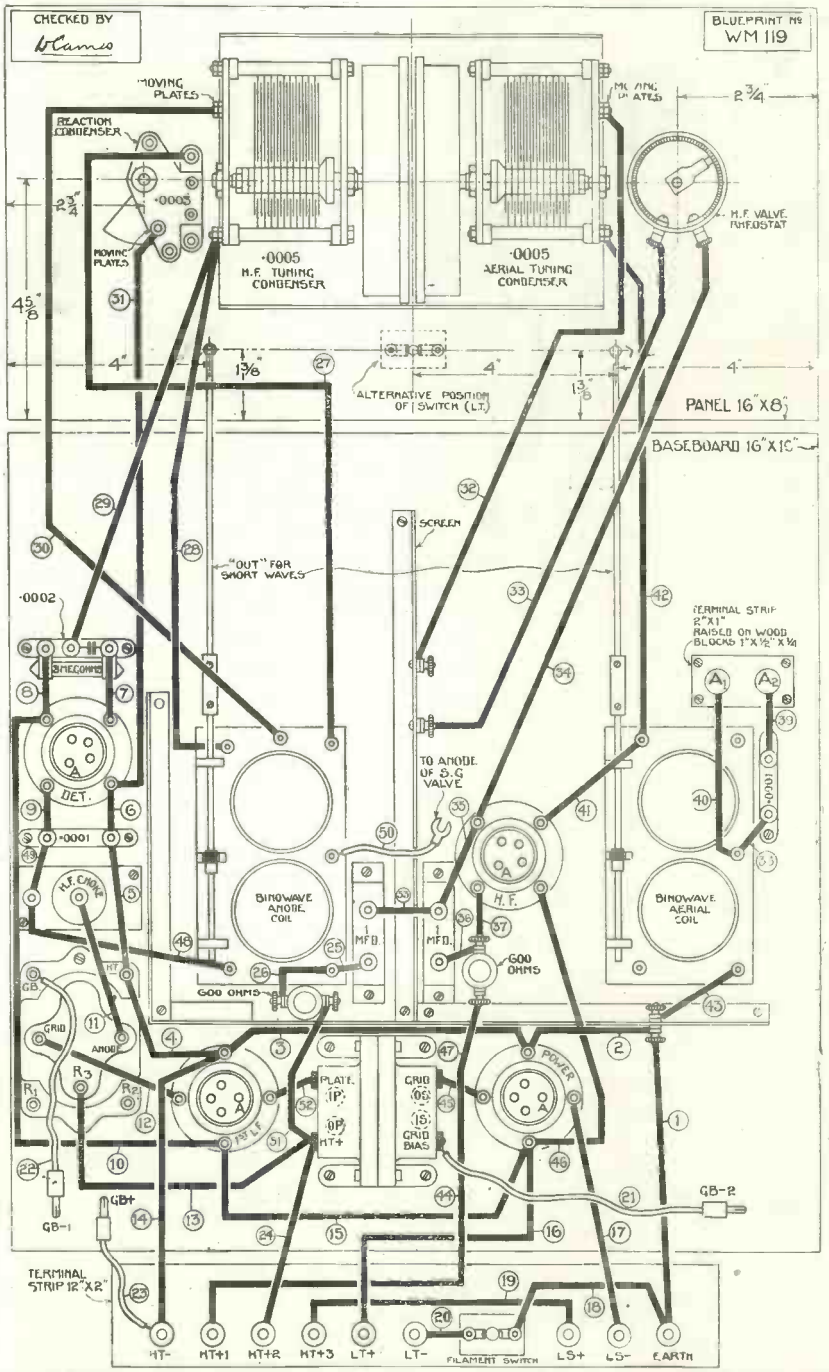
Apply the correct voltage for the screen of the shielded valve at terminal H.T.+1 and a voltage of 120 at terminal H.T.+2. For really good loud-speaker results a voltage of at least 150 is recommended for the power valve and should be joined to H.T.+3.

Tuning the Receiver

To tune over the lower wavelength band pull both switches "out" and turn the two tuning condensers together. They will read approximately alike when the aerial is connected to terminal A2, as the .0001-microfarad condenser is included in the aerial circuit.

Always keep the volume control turned *well down* and never use too much reaction.

When an indoor aerial is used it should be connected to terminal A1, as the tuning would be too sharp were it joined to A2, and it is, of course, necessary to use a reasonably good earth.



This 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 by January 31. Ask for No. W.M.119; and address your inquiry to Blueprint Dept., "Wireless Magazine," 58/61 Fetter Lane, E.C.4. When wiring up connect the leads in the numerical order indicated. If desired the leads, except 1, 2, 32, 33, 43, 46, 47, 48, 49, 50, and 51, can be wired without the screen in position

Wireless Magazine, January, 1929

Capt. H. J. Round Discusses Transformer Problems

EVEN if resistance capacity amplification were suitable for all intervalve work and the intervalve transformer quite unnecessary, there would still be many cases in radio and allied work where a transformer is necessary.

Croup of three Ferranti transformers, the AF5, AF4 and AF3

The subject of transformers is thus of vital interest, especially as they are rather like loud-speakers in that they are difficult things to design to give all we want.

I am only going to discuss in this article the transformer for low-frequency work, because those for high-frequency are required, as a usual thing, to have different properties from the low-frequency article.

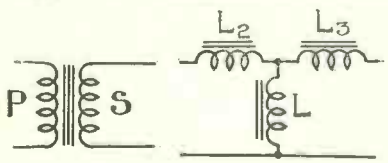


Fig. 1.—Transformer and its electrical equivalent

A transformer is essentially for use in alternating-current work and is, in the main, a device to give us our energy in a form in which it can be used economically.

A Simple Example

As a simple example, suppose we have 200-volt mains in the house and we wish to light up a 10-volt 10-ampere lamp. We can, of course, insert a resistance to use up the unwanted 190 volts, but this would be very wasteful, and so we introduce a 20/1 step-down transformer, resulting in a high overall efficiency and very little waste if the transformer is designed correctly.

Let us follow this point out a bit further and examine what is meant by correct transformer design. The transformer will have a closed iron core and a primary winding, and we know this will have a certain inductance, L.

If this inductance L is so small that it allows a heavy current to pass before the secondary of the transformer is connected to the lamp, then obviously we shall have a waste and the transformer will get hot. We must increase the inductance until this light-load current is small and then put on a secondary which is the ratio for the voltage output we want.

Alteration of Frequency

Suppose we had designed such a transformer and in the particular case we had put on plenty of turns and now, by some accident, the electric-light mains were altered from 50 cycles to 25 cycles.

The inductance of the primary is still the same, but its impedance is now only one-half of what it was before, because the impedance is $2\pi nL$, where n is the number of cycles in the A.C.

The transformer will thus be less efficient and, as the number of cycles is decreased, will steadily get less and less efficient.

Obviously, if we want to design a transformer to handle a lot of frequencies, as we do in L.F. work—say, from 50 cycles to 6,000 cycles—we must design the primaries for the lowest frequency, which leads us into further trouble.

However good we make the iron circuit in a transformer, and however much we sectionalise the primary and secondary, all the magnetic field produced by the primary does not go through the secondary—in fact we get a leakage.

It is quite easy to see that this leakage is just as though we had a perfect transformer (Fig. 1), and in series with both primary and secondary we put little choke coils, L2 and L3, to represent the leakage.

Now, thinking of this analogy or equivalent, see what happens in a transformer as we raise the frequency.

No-load Current

We have designed the transformer for 50 cycles, so that there is quite a small current passing through the primary before the secondary and the secondary load are added.

If there were no leakage present, then as we raise the frequency the transformer would just get a little more efficient up to the highest frequencies we wanted to use.

But leakage acts, as we have seen, like a choke (Fig. 1), and the chokes L2 and L3 have more and more impedance as the frequency is raised.

Although the rise of frequency is good in that it reduces the magnetising current of the transformer, the leakage steadily chokes back our voltage as the frequency is raised, and the load, which we assumed to be a 10-volt 10-ampere lamp, gets less and less voltage.

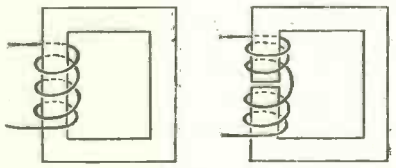


Fig. 2.—Chokes without and with air gaps

Devil and deep sea—I do not know what the origin of that alternative was, but it has its analogy in every

invention. In the transformer it is particularly applicable, for if we put more turns on the primary and secondary to make the transformer more efficient at the bass end of the spectrum, then this addition of more turns adds to the leakage and increases the inefficiency at the high frequencies.

A Few Months Ago

Everything had been done with ordinary materials that could be done, and you saw the result in the intervalve transformers issued by various manufacturers.

I say everything had been done that could be done, but I must qualify this by adding within a reasonable size and price, because we could improve transformers with ordinary materials if we increased the quantity of iron very greatly.

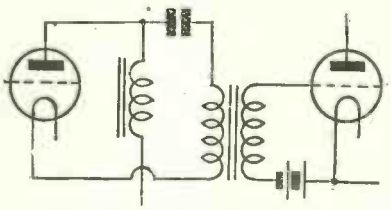


Fig. 4.—Choke-fed intervalve transformer

A transformer with four times the amount of iron would definitely give a better curve over the frequency range than one with a normal core, particularly if that iron was shaped in the correct way—but size, weight, and cost would all tell against it.

Nothing better with a reasonable size was possible until the discovery in America of a more magnetisable iron, which was given the name of permalloy. The primary winding of a transformer produces a magnetic field which exists mostly in the iron core, because very little force is required to produce many magnetic lines in iron.

Sectionalised Windings

Some of these magnetic lines, however, find that there are easier paths through the air than round the circuit they have to travel. If they stayed in the iron, a very large percentage of the lines produced by the primary turns would go through the secondary turns, and there would be very little leakage, but these lines that prefer the air path tend to miss the secondary, although this effect is minimised by the well-known method of sectionalising the primary and secondary and interleaving these sections.

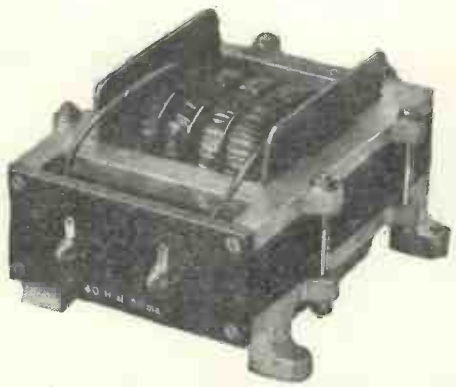
By introducing iron cores which are very much easier to make magnetic lines in than, say, stalloy, we can make the iron circuit so attractive to the lines that they prefer it to any air path—the result being that the leakage is greatly reduced and we are much nearer to the perfect transformer than before.

There is one very important thing to notice, and that is that under no circumstances must the iron be overloaded with lines, for iron loses its wonderful magnetic conductivity if forced too much.

This new American iron (permalloy by name, for it is really an alloy of iron and nickel) will not take more total magnetism than stalloy, but to drive it to its maximum magnetism requires only one-fifth of the current that stalloy requires, and we can say that with the same primary winding we shall have very much less leakage than before. Now we can put up the primary inductance, thus improving the bass efficiency without seriously injuring the top frequencies.

I have just said that we must not overload the iron with magnetic lines, and one very important cause of overloading is that not only do we pass the alternating current through the transformer, which is legitimate and necessary, but in many of our circuits we pass direct current through the winding as well.

Any passing of direct current through a transformer definitely makes the leakage greater, because iron is harder to make magnetic lines in as the lines get more crowded, and at a certain crowding, called saturation, very few further lines can be passed. At this place the leakage would be very large.



A Parmeko choke: it has an inductance of 40 henries when carrying a direct current of 50 milliamperes

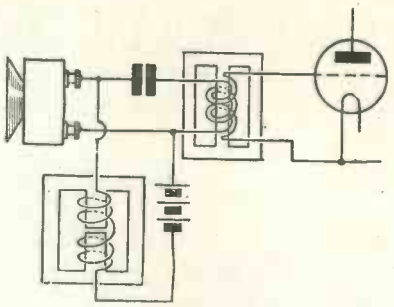


Fig. 3.—Choke-fed microphone transformer

It is the very best practice never to allow direct current to pass through a transformer, but to by-pass that current through a choke (the choke value of which is so high that very little alternating current can pass through it), and to get the best out of the new permalloys, this choke feeding is very necessary.

A Pretty Little Trick

Chokes do not suffer with the leakage difficulty. As we put turns on an iron core to make a choke all we have to watch is that the iron does not get overcrowded with lines, and there is a pretty little trick for preventing that in a choke which cannot be employed in a transformer.

Suppose 1,000 turns on a certain iron core gave a choke value of 1 henry and on some particular apparatus we were just saturating the iron due to the fact that there was, say, 50 milliamperes of direct current flowing as well as the A.C.

If we wanted 4 henries of inductance instead of 1 henry, the straightforward way would be to increase the number of turns to 2,000. But the iron would be now very saturated, due to the 50 milliamperes of D.C.

Two Courses

Two courses are now open to us. We can increase the whole size of the choke, or we can put an air gap in the iron, and the cheapest way is usually the latter.

If we put a gap in the iron (Fig. 2), which has three times the magnetic resistance of the rest of the iron circuit, then 1,000 turns will only be .25 henry, but if we increase the winding to 4,000 turns, we shall have 4 henries of inductance, and the 50 milliamperes of D.C. will only just take us to saturation as

Capt. Round Discusses Transformer Problems (Continued)

before in the 1-henry case. Any attempt to put a gap in a transformer at once greatly increases the leakage, with a consequent loss of high frequencies.

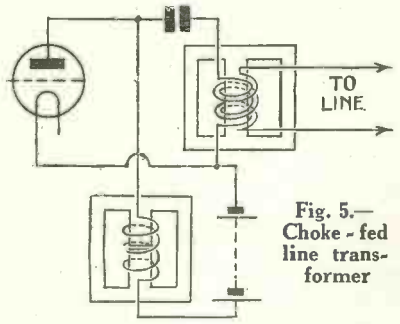


Fig. 5.—Choke-fed line transformer

These modern irons magnetise so easily that all direct current should be kept away from them if the best possible results are required.

I illustrate two or three cases (Figs. 3, 4, and 5) where choke-fed transformers will not only improve the results when using ordinary iron, but will make for very great improvement when permalloy or similar material is in use.

There is no apparent advantage in using permalloy for the choke, and it should be noted that the choke value must always be high compared with the choke value of the transformer winding, and the coupling condenser must be of low impedance compared with the transformer winding at the lowest frequencies being used.

Really Simple

Quite a complicated problem apparently is the design of these various couplings, but it is really only simple arithmetic, which has to be carefully checked by experiment, as there are always quantities coming in which cannot be exactly allowed for.

Nearly all our transformers have at the frequencies we use them capacities which affect their action, and in addition capacities which we cannot avoid are added by the remainder of the gear.

A very great number of our problems consist in arranging to connect some circuit in which alternating current occurs, sometimes mixed with D.C., to the grid of a valve. Now the grid of a valve requires, in the main, volts, and but for the capacity of this valve and the capacity of the transformer winding we could use much higher step-up transformers.

The sum of these capacities and the inductance of the secondary of the transformer are usually arranged to resonate somewhere about a middle frequency, say 800 cycles, and then the resistance of the circuits attached to the primary, be they microphone or valve, are arranged to damp this resonance curve out as flat as possible.

Obviously in this design we are limited by the valve capacity to a certain secondary, and our primary must have a sufficient number of turns to get in the bass, with the usual result that if the primary is made as long as we should like to get a strong bass, leakage enters in to produce the curious accentuation of the high notes, shown in Fig. 6.

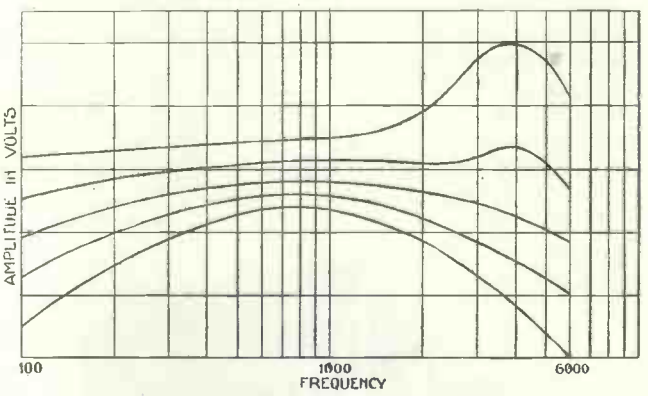


Fig. 6.—Transformer curves with different primary-shunting resistances

The top peak is really due to the resonance of the leakage inductance and the valve capacity, and also, of course, we lose in step-up ratio.

The use of the new iron alloys will permit of a much greater flatness—without this over-accentuation at the top of the curve—or, as an alternative, greater amplification with the same characteristics as the old iron gave.

Fig. 6 illustrates what happens at different frequencies as the resistance of the valve attached to the primary is steadily decreased, the top curve is steadily decreased, this being with the lowest resistance value.

I apologise for not drawing this series of curves correctly—the middle part of the bottom curve should really be above the top curve—but it complicated the drawing considerably, and I merely want to illustrate the general shape of the different curves.

Use of R.C. Couplings

As I said at the beginning of my article, flat characteristic intervalve transformers are not very important, as R.C. coupling with high-value valves will give us all we want, but there are places where we must use a transformer.

Thus the B.B.C. microphones have a resistance of about 200 ohms, and they have to be connected to the valve amplifier through an efficient transformer.

You really cannot use R.C. coupling from a mere 200-ohm article, although I have done it when I wanted to get frequencies as low as 10 and 20 cycles from the microphone.

Results

With an ordinary transformer a result just about as good as we get with transformers between valves is possible, but with permalloy and choke feed a curve which is flat from 50 cycles to 6,000 can be obtained with a step-up ratio of 12 or 15 to 1.

Again, when the B.B.C. wish to connect an amplifier to a telephone line—and then from that telephone line to another amplifier or to the transmitter itself—transformers are an absolute necessity. Here the new alloys are of great importance to enable us to get level curves.

And finally, of course, there is one very important use of permalloy, and that is to give us a transformer with a performance equal to the older transformers, but with a much smaller size, for portable sets and the like.

A STATION IDENTIFICATION BUZZER WAVEMETER

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

Simple to Build

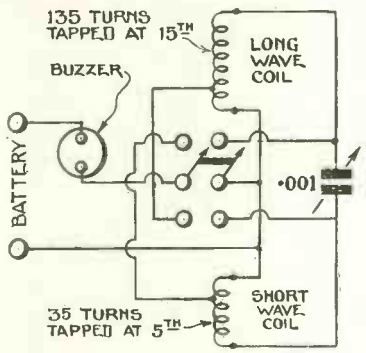
Low in cost—approximately 32/6

BUZZER wavemeters have been used for many years. Their characteristics are well known, and those who are accustomed to using them appreciate the advantages of these simple little instruments.

Reliable in Use

It must be admitted that they are supposed to be a little troublesome. One sometimes hears it said that buzzers do not always buzz and that a wavemeter of this type is not to be regarded as a precision instrument worthy of a place in an experimental laboratory.

But modern buzzers are reliable. They can be so adjusted that they always buzz with a practically uniform frequency whenever they are switched on. In fact, those who have a well-designed buzzer wavemeter regard it as a very valuable instrument.



Circuit of the Buzzer Wavemeter

Few Components

The fact that it comprises so few components, which are not likely to get out of order, is a great point in its favour. All that is required is a reliable tuning condenser, a coil, and a battery to energise the buzzer, with a switch for bringing the circuit into operation.

A defect of certain types of instrument is broad tuning and too loud a buzz. This is because they were designed for use with crystal receivers, which are relatively insensitive and not sharply tuned. A different type of circuit is necessary for a wavemeter which is to be used with valve receivers.

In the first place, reasonably sharp tuning is essential, and it is preferable that a relatively weak signal be emitted in order that the receiver may be fully tuned to it without grossly overloading the valves of the receiver.

These essential characteristics may be obtained by employing tuning coils of reasonably low high-frequency resistance and by connecting the buzzer to a portion of the coils instead of across the whole of them. Litzendraht has a lower resistance than solid wire, but there is no need to use it when the coils are suitably proportioned as regards their length and diameter, and when the tuning condenser has a large maximum capacity.

Small Tuning Coils

In the instrument illustrated, the tuning condenser has a maximum value of .001 microfarad and, as a result of its large capacity, relatively small tuning coils provide sufficient inductance for the desired wavelength ranges.

From the diagram of connections it will be seen that two separate coils are employed, with a switch which connects one and short-circuits the other, and *vice versa*.

Buzzer Connections

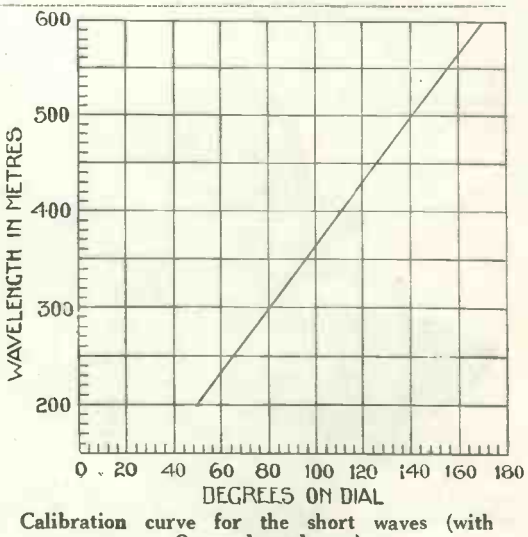
The buzzer is connected to the coils through the second set of contacts of the switch in order to include a proportion of them in the buzzer circuit. As this proportion is reduced the tuning becomes sharper, and the strength of the buzz heard from a receiver tuned to it becomes weaker.

Sharp Tuning

The instrument has been so proportioned that the tuning is reasonably sharp and the buzz not too loud when used with an ordinary

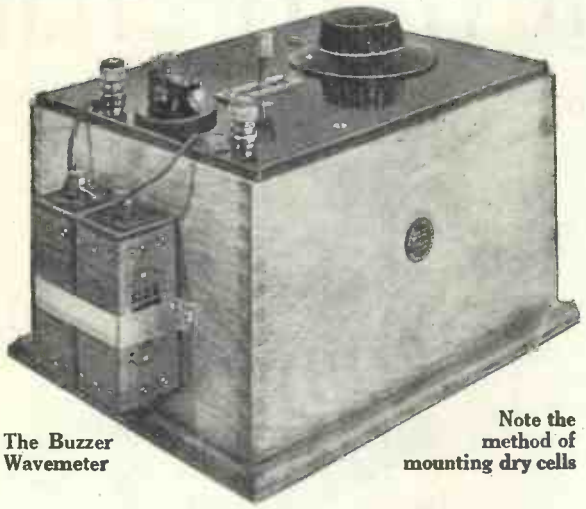
COMPONENTS REQUIRED

1—Ebonite panel, 9 in. by 6 in. (Becol, Parfait, or Red Triangle).
1—.001-microfarad square-law variable condenser (Ormond R 124a).
1—Two-pole change-over switch (Utility).
1—Buzzer (Bulgin).
2—Terminals, marked: +, — (Belling-Lee or Eelex).
1—Dial indicator (Bulgin).
1—Paxolin tube, 3 in. diameter by 4 in. long (Wearite).
2—Dry cells (Siemens type T).
1—Wood box (Pickett Bros.).
4—Small terminals.



Calibration curve for the short waves (with Ormond condenser)

A Station-identification Buzzer Wavemeter *(Continued)*



The Buzzer Wavemeter

Note the method of mounting dry cells

three-valve set. Sufficient strength is obtained with smaller receivers by bringing the wavemeter nearer the aerial or one of the coils in the receiver, and when the set is a very powerful one it will be necessary to weaken the coupling with the wavemeter.

To do this it is only necessary to turn the wavemeter in order that the coils may point away from those in the receiver.

Simple Construction

The diagram of connections shows how simple is the arrangement. When a dry-cell battery is connected to the terminals indicated, and the switch is moved into its long- or medium-wave position, the buzzer is actuated and high-frequency oscillations having a wavelength determined by the constants of the circuit are created. A wide range of wavelengths is covered with the two coils, and as they are securely fastened to the panel the calibration should remain reasonably constant.

The particular tuning condenser employed should prove satisfactory for ordinary purposes as extreme accuracy is not an essential. Even the best instruments vary a little and it is hardly worth while to purchase an expensive condenser for a wavemeter of this type.

The short-wave coil comprises a former 2-in. long which should be cut from the 4-in. length of tubing. Fit two small terminals as shown in the layout diagram and wind 35 turns of No. 24-gauge double-silk covered wire. A tapping should be made at the fifth turn.

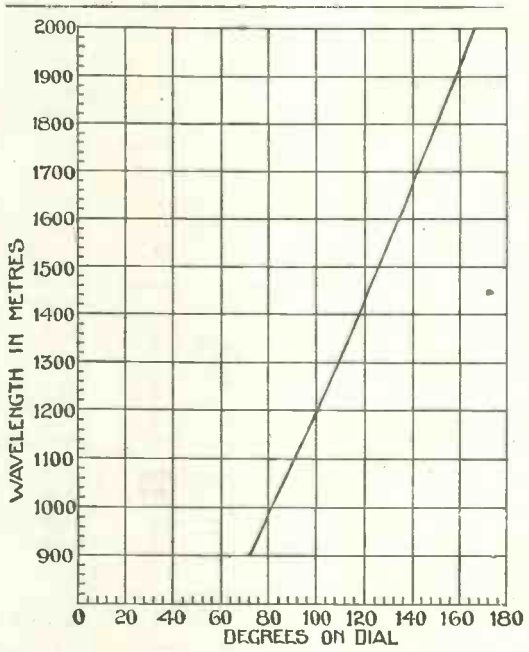
Two further holes have to be drilled in the tube in order that fixing bolts may be employed to hold it in position.

For the long-wave coil a total of 135 turns of No. 36-gauge double-silk covered wire should be wound on the second 2-in. length of former and the tapping made at the fifteenth turn. This former must also be drilled for the fixing screws.

The two coils are mounted on the panel, but are held away from its surface by small pieces of ebonite or wood about half an inch long. This is in order that the coil formers shall not touch the switch.

The positions of the remaining parts are clearly shown in the diagram and the wiring is so easy that it is not necessary to make further reference to this part of the construction.

Having completed the instrument and connected the two dry cells, which are held to the side of the case by a brass strap, it is necessary to begin the work of calibration. Move the switch in order to connect the medium-wave coil and, with your receiver tuned to the local station, adjust the tuning condenser of the wavemeter until the buzz emitted by the loud-speaker is heard most strongly.



Calibration for long waves (with Ormond Condenser). This curve will be reasonably accurate if the condenser specified is used. It will be only a rough guide if another condenser is substituted

Repeating the Process

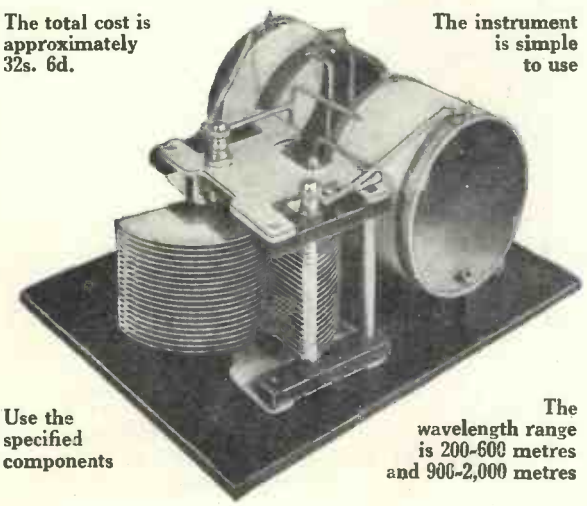
Make a note of the dial reading and the wavelength of the station. Now re-tune the receiver in order to receive another known station.

Once again adjust the condenser of the wavemeter in order to hear the strongest signal from the loud-speaker. Make a note of the dial reading and the wavelength. You now have two points of known wavelength.

If you are able to receive a few

The total cost is approximately 32s. 6d.

The instrument is simple to use



Use the specified components

The wavelength range is 200-600 metres and 900-2,000 metres

Indispensable to Every Keen Listener

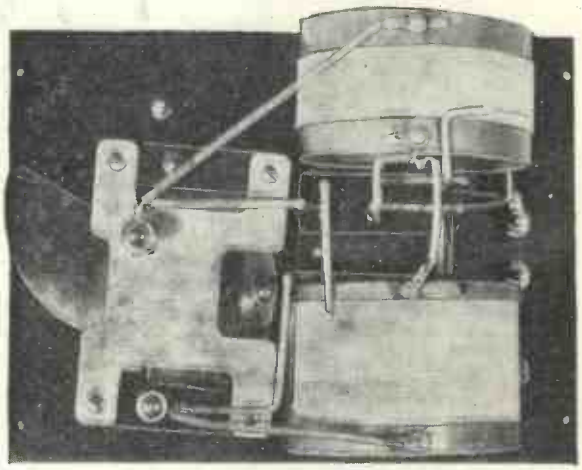
other stations whose wavelengths are known to you, it will be an easy matter to determine further points from which a curve such as that shown on page 539 may be drawn. This curve may not in the first instance be very accurate, but as you hear other stations and identify them you will be able to obtain further points and eventually a reasonably accurate calibration will be available.

Long Wavelengths

The same procedure may be followed for the longer wavelengths and the curve of the instrument illustrated is that opposite. This may be taken as a rough guide for your own instrument.

instrument and it is suggested that a piece of squared paper with the calibration curves drawn upon it be fastened to one side of the case.

A wavemeter is particularly useful when a receiver is faulty, as by placing it near one of the tuning coils a relatively strong signal is induced in it. When there are high-frequency stages it is convenient to be able to introduce a signal into the detector circuit and then to work towards the aerial in an endeavour to determine which circuit is the faulty one. But, perhaps the greatest use of a wavemeter is when testing a new receiver. Not only can the circuits be quickly brought into tune at any particular wavelength, but when a distant station is heard rather weakly owing, perhaps, to the set not being properly adjusted, this station may be identified from the calibration of the wavemeter.

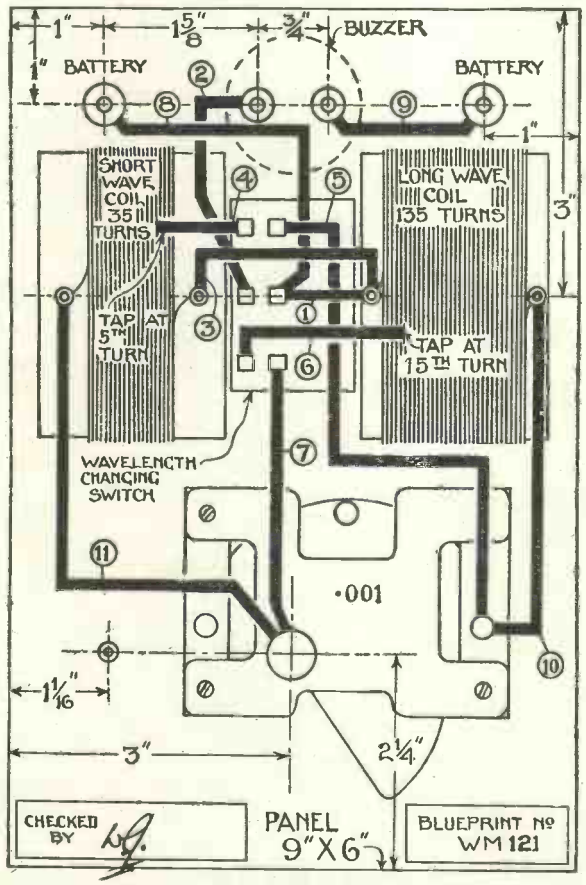


Under panel view of the Buzzer Wavemeter

Once it has been calibrated, a wavemeter will enable you to measure the wavelength of any unknown station in a few moments and then identify it from a list of broadcasting stations.

In this particular instrument, the buzzer is switched off by putting the switch-arm in a vertical position. When the arm is moved towards the buzzer a wavelength range of 900 to 2,000 metres is covered and when it is moved towards the condenser dial the range is 200 to 600 metres.

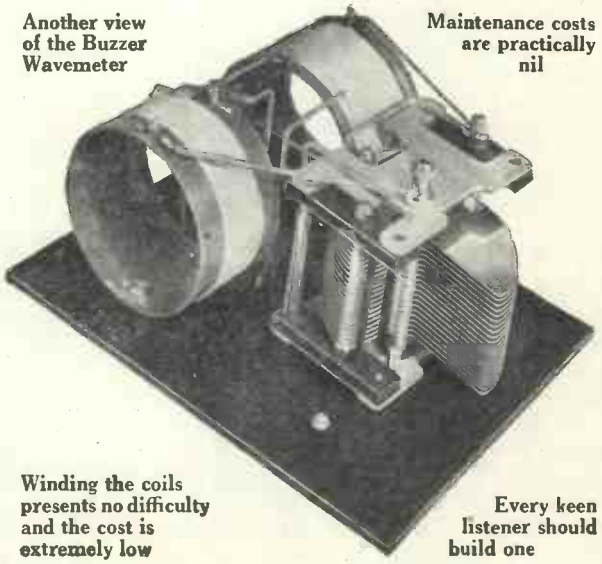
For ordinary use the dry cells can be expected to last for a year or more. The first cost of the wavemeter is low and the maintenance cost practically negligible.



This layout and wiring diagram can be obtained for half-price (that is, 3d., post free) if the coupon on page iii of the cover is used by January 31. Ask for No. W.M.121

Another view of the Buzzer Wavemeter

Maintenance costs are practically nil



Winding the coils presents no difficulty and the cost is extremely low

Every keen listener should build one

THE B.B.C. IN 1928

A YEAR'S ACTIVITIES REVIEWED · BY SAVOY HILL OFFICIALS ·

THE year 1928 was no less productive of fresh bursts of activity in broadcasting than any year precedent thereto, since those magic letters of nation-wide intimacy, "B.B.C.," first came to have a meaning in the home life of the people.

On the threshold of the year that is past the clarion note was sounded of the policy which has guided broadcasting from the start. The Corporation decided to initiate, on January 2, an experimental series of weekday religious services, broadcast from Daventry 5XX only, from 10.15 to 10.30 each morning.

Keen Interest

Within a few days the executive officials at Savoy Hill were placed in possession of information which showed conclusively that since broadcasting began there had been nothing to arouse such keen interest and pleasure as this daily religious service.

By the end of the third week over 5,000 letters from appreciative listeners had been dealt with, and before the experimental period had passed it became clear that here was a programme feature which must be retained at all costs, and the decision was arrived at that the service should be extended to 2LO.

On January 5 the first important musical relay of the year took place from the Queen's Hall, the occasion being the Royal Philharmonic Society concert. The conductor was Ernest Ansermet, the well-known Swiss musician.

5GB's Performance

Although Daventry 5GB had been functioning for several months, it was not until January, 1928, that transmissions improved to the point where expressions of dissatisfaction with the station's performance practically ceased. This happier state of affairs was achieved when, on January 10, a new and higher aerial was put into service, the result being that while Birmingham listeners lost nothing by the change, and no alteration in reception conditions took place in the south-west and south-east, the strength in other districts, particularly in the north, north-east, and south, showed on practical tests a marked increase.

One of the most successful programme items of the previous year was repeated on January 16, when the Ceremony of the Keys was broadcast from the Tower of London. For this relay nine microphones were required; these included installations at the main entrance gate of the Tower, at Middle Tower, at Byward Tower, between the Byward and Bloody Towers, at Bloody Tower, and on the parade ground. There was also a microphone at the back of the King's House, so that listeners might hear the keys being handed over by the escort. An engineer was in charge of an amplifier at each microphone for fading the latter in and out as required, according to the movements of the Guard.

First Recital in England

The first performance in England of his "Gurrelieder" ("Songs of Gurra") was conducted by the composer, Arnold Schonberg, at the Queen's Hall on January 27. Schonberg was the originator of the trombone *glissando*, which was heard for the first time in the "Gurrelieder" and is now used universally by composers.

The performance was undertaken by the B.B.C. with some trepidation, as the work had not previously been given in this country because its score demanded tremendous forces, both in orchestra and chorus, as well as five principal vocalists and a speaker; but B.B.C. enterprise appeared to be justified, for while novelties in music usually arouse a certain hostility, on this occasion the voice of the critic was the merest whisper.

On February 3 the whole of the memorial service for the late Field-Marshal Earl Haig was relayed from Westminster Abbey, and the service lost none of its grandeur and solemnity when transmitted to millions of listeners by all B.B.C. stations. The opinion was afterwards expressed that greater use should be made in the interests of religion of the impressive ceremonies which take place in the Empire's most venerable edifice.

Charitable Appeal

A charitable appeal that stands out pre-eminently in the annals of broadcasting, and constitutes a record which will perhaps remain for all time, was broadcast on February 5 by Lord Knutsford, the chairman of the London Hospital. This appeal resulted in contributions amounting to upwards of £20,000 being received from that generous army of listeners by whom the call of the deserving seldom remains unheeded.

In February also was born the National Orchestra of Wales, an organisation evolved by the Welsh National Council of Music, the National Museum of Wales, and the City Corporation of Cardiff, in co-operation with the B.B.C. The latter undertook to support the scheme financially, the Cardiff Corporation agreed to provide the Assembly Rooms at the City Hall for some of the concerts to be given by the orchestra, while the Council of the National Museum permitted the use of the Museum for others.

The control of the orchestra, which began with a personnel of thirty on a permanent salary basis, was vested in a council consisting of representatives of the organisations named above.

Dame Ellen Terry

Dame Ellen Terry's eightieth birthday anniversary was celebrated with a special programme, broadcast on February 27, when excerpts were given from some of the plays in which the great actress made her name. Distinguished actors and actresses took part in this broadcast,

to which Dame Ellen, although even then in the throes of that last illness which proved fatal, listened from her bedchamber.

On March 5, following the Prime Minister's statement in the House of Commons, the Governors of the B.B.C. announced their gratification at the ultimate success of the application for authority to include controversial matter in the programmes. This signalised the end of a five years' effort by the B.B.C. to secure this extension of its activities.

Political Broadcasts

One of the first moves was to offer the three political parties the hospitality of the studio for a talk; but at the end of eight months the parties have not availed themselves of the opportunity for which, according to their spokesmen in the Press, they had been hungering.

Mr. Churchill broadcast an explanation of his Budget on April 25—an excellent attempt technically, to which realism was added by the Chancellor's question at the end, while the microphone was still "alive": "Is that all right?" The B.B.C. official's reply was, however, not heard by listeners.

The first uncensored wireless debate took place on May 18 between Sir Ernest Benn and Mr. James Maxton, M.P., their subject being "Riches and Poverty—Are They Necessary?" The animated comments and exchanges of opinion, with bright humorous interjections by each while the other was speaking, introduced a new note into broadcast speech which was greatly appreciated by listeners.

That Luxury Set!

"We are shortly introducing a luxury receiver containing several screened valves. This new . . . product will undoubtedly prove 'worth waiting for'."—*Extract from manufacturer's catalogue.*

Whenever some radio catalogue states
That a firm is producing a luxury set,
I utter a curse on the rent and the rates
And indulge in a horrible threat;
For what is the use of this model to me,
How on earth can I hope to adopt the suggestion,
When I happen to know jolly well that the fee
Will be utterly out of the question?

I'm always considered a bit of a fiend
Where the latest of luxury sets are discussed,
For it's valves I am craving (both pentode and screened)
With a real and fanatical lust;
If only the set, I repeat, could be mine,
I would wallow ad lib. *in celestial bliss*
As I sat down to listen each evening at nine,
And what pleasure more perfect than this?

But there! What's the use of my sighing for quids,
For at present my desk is belittered with bills,
And I'm owing the doctor for treating the kids
For the measles and similar ills;
And should I be tempted to purchase this set
It would only reduce me to cerebral fever,
For the only receiver I'll certainly get
Will be called the Official Receiver!

C. P. P.

(*Moral: Build your own set.—Ed.*)

Choral Programme

An outstanding event of this period was the relay to British listeners of a choral programme by the famous Lègia Choir from Liege. This transmission was brought on March 11 to Savoy Hill by telephone line and submarine cable, and broadcast as part of the Belgian National programme. On March 12 the first simultaneous broadcast took place from British and German stations, the second act of *The Marriage of Figaro*, performed in the studio of the Cologne broadcasting station being relayed to London. On March 13 a programme by the London Chamber Orchestra, radiated from 5GB, was simultaneously relayed to the Cologne station as a *quid pro quo*.

A similar relay took place from Vienna on November 18 in connection with the Schubert Centenary, a talk by Professor MacCallum being conveyed by means of land-line to Savoy Hill.

The Prince of Wales' first broadcast of the year took place on March 21, when, as Master of the Merchant Navy and Fishing Fleet, he spoke at the annual banquet of the Company of Master Mariners at the Mansion House. On March 28 the first production in the London studio of a play by Mr. Bernard Shaw, *The Man of Destiny*, was given. Two days later the Grand National at Aintree formed the subject of a running commentary by Mr. Geoffrey Gilbey; while on the last day of the month Mr. G. O. Nickalls and Mr. J. C. Squire collaborated in a running commentary on the Oxford and Cambridge boat race, radiated from the launch *Magician*, which was following in the wake of the crews.

The B.B.C. announced on April 25 that the Postmaster-General had sanctioned the erection of the first of the new high-power twin-wavelength stations contemplated by the Corporation in its regional scheme. It was expected that the station, which would be constructed at Brookman's Park, Potters Bar, would be open for service within twelve to fifteen months' time.

The Nightingale

Several attempts were made early in May to broadcast the song of the nightingale from Pangbourne, near Reading, and eventually, on May 12, great success was achieved. The song of the bird was heard in New Zealand through the short-wave station, 5SW, and was perfectly clear, sweet, and audible. The song was actually transmitted for two periods of six minutes each, and was finally heard to the sound of the village clock at Pangbourne striking the hour of midnight as a background.

An outstanding musical event was the performance of Igor Stravinsky's *Oedipus Rex*, which the composer conducted in the London studio on May 12. The scenes of this opera-oratorio were linked together by a speaker, as in Honegger's *King David*, which was broadcast from the Albert Hall some months previously, the intention being to inform hearers of the movement of the action in order that they might concentrate on the musical structure itself.

New Bridge

On May 16 the Prince of Wales opened the new Royal Tweed Bridge across the River Tweed at Berwick, and the ceremony was broadcast from Newcastle station and relayed to London and all other stations throughout the kingdom. The broadcast included the Prince's speech and the actual ceremony of opening the bridge.

Towards the end of May the B.B.C. published the names of members of

The B.B.C. in 1928 (*Continued*)

the Interim Committee set up on the recommendation contained in the Report of Sir Henry Hadow's Committee, to advise the Corporation on questions connected with the composition and launching of the proposed Central Council for Adult Education and on current adult education policy. This Committee held several meetings under the chairmanship of Lord Justice Sankey, and continued its labours until the launching of the Central Council, which held its first meeting on November 8.

At the Listening End

At this meeting the Council were asked to consider schemes for the setting up of Area Councils to organise activities at the listening end, to encourage and control the formation of listening groups in connection with wireless talks, and to report local interest and needs for consideration by the Central Council and the B.B.C. An executive committee to sit for a period of two years was elected.

During May the B.B.C. completed an addition to the studios at Savoy Hill, bringing the number then in use up to nine. No. 9 studio is 22 ft. long by 19 ft. 6 in. wide, and it occupies the site of a Turkish bath which was a popular resort in the London of pre-war days. The decorative work marked a complete innovation. The studio was painted in red, black, and gold, and its walls were embellished with a pictorial scene of Chinese character in which the phœnix predominated.

Derby Narrative

On June 6 a descriptive narrative of the Derby was given by Mr. R. C. Lyle from the course at Epsom. This was Mr. Lyle's first attempt at a broadcast commentary, and was so successful that he was commissioned later in the year to act in a similar capacity in connection with the St. Leger broadcast on September 12 and the Northumberland Plate broadcast from Newcastle on June 27.

The next important musical broadcast—at which one of Europe's most eminent conductors, Georg Schneevoigt, was in charge—took place on June 8 and was a symphony concert given in 2LO studio. The broadcast included the famous Saint-Saens "G minor Concerto," in which the soloist was Madame Schneevoigt.

On June 12 the Prince of Wales' speech on the occasion of the unveiling of the Welsh National War Memorial was relayed from Cardiff to Daventry 5 XX and several other stations. The transmission included a descriptive narrative of the event by the Cardiff station director.

On June 17 the first broadcast took place from St. George's Chapel, Windsor.

Miss Amelia Earhart, the first woman to fly the Atlantic, broadcast from 2LO and 5XX on June 25, when she spoke at a luncheon of the Air League of the British Empire. In addition to Miss Earhart's speech, listeners heard the Duke of Sutherland, Lady Heath, and Captain Wilmer Stultz, who was Miss Earhart's pilot on the epoch-making flight. Another running commentary which may be recalled was that on the Royal Air Force Display relayed from the Aerodrome, Hendon, on June 30. This was given by two serving officers of the R.A.F., who described several of the chief events at Hendon.

Welsh Programmes

Beginning in July, the B.B.C. instituted a new series of characteristically Welsh programmes once a quarter from Daventry 5XX. The new series was undertaken to gratify Welsh national sentiment as a temporary measure pending the establishment of the regional scheme, and the programmes, it was announced, would be constructed to reflect the highest attainments of Welsh literature and art, and would be announced in the Welsh language.

During this month plans for the reconstruction of the National Chorus were put in hand. Applications were invited for membership from amateur choral societies in London and the Home Counties, and from the several thousand communications received the B.B.C. selected one thousand applicants who were given auditions over a period of three months.

From this number, 250 choristers were selected to form the National Chorus, which made its debut at the B.B.C.'s symphony concert at the Queen's Hall on November 23 in an oratorio entitled *The Pilgrim's Progress*, by Professor Granville Bantock, which was specially commissioned for broadcasting.

British Legion Pilgrims

Broadcasting played its part in the great British Legion Pilgrimage to the battlefields at the beginning of August, the service which marked the climax of that pilgrimage being relayed from the Menin Gate to all stations of the B.B.C. except 5GB, and broadcast also from the Chelmsford short-wave station. The cable used for the transmission from Ypres Post Office to London was the same as that used for relaying the opening ceremony at the Menin Gate by Lord Plumer in July, 1927.

The thirty-fourth season of Queen's Hall promenade concerts, and the second under the direction of the B.B.C., opened on August 11. In 1927, as the experiment was regarded as a critical try-out for broadcasting, the season was limited to six weeks. It met with such success that the B.B.C. felt justified in extending the 1928 season to eight weeks. Sir Henry Wood conducted as usual, and the programmes were run on the traditional "Prom" lines.

At the conclusion of the promenade season the B.B.C. symphony concert season, the successor to the old "National" concerts, opened on October 12 at Queen's Hall with a conductor who was formerly one of the most hostile critics of broadcasting and its influence on music, namely, Sir Thomas Beecham. During the season, which extends up to April 12 next, eminent conductors like Sir Hamilton Harty, Professor Granville Bantock, Francis von Hoesslin, Ernest Ansermet, Albert Wolff, Gino Marinuzzi, and Sir Landon Ronald will conduct performances.

Sir James Barrie

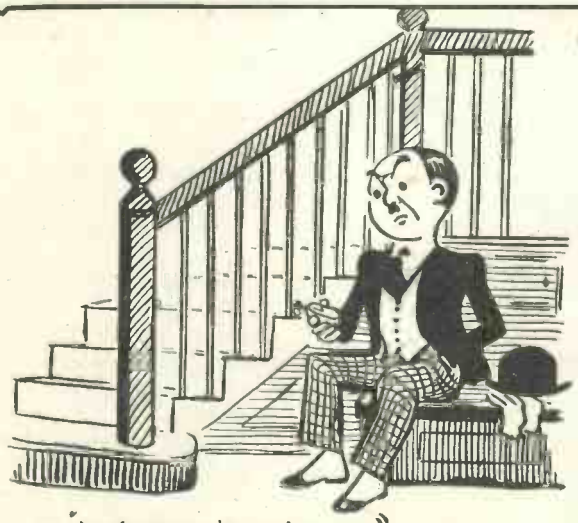
The World's Great Plays was a series introduced on September 11, and consisted of selected plays from the drama of Britain, Belgium, Norway, Spain, and other countries. On October 15 the first broadcast by Sir James Barrie took place on the occasion of his receiving the Freedom

(*Continued on page* 596)

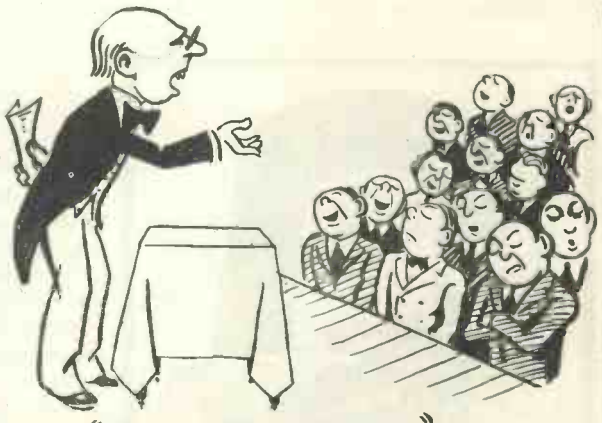
A WIRELESS FICTIONARY

"ALTERNATE CHOICE".

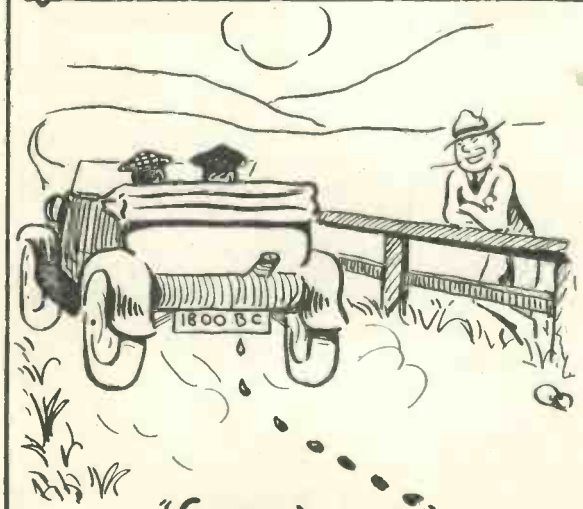
"SIMPLE TUNING".



"WOMAN'S HOUR".



"DULL EMITTER".



"GRID LEAK".

"INCESSANT OSCILLATING".

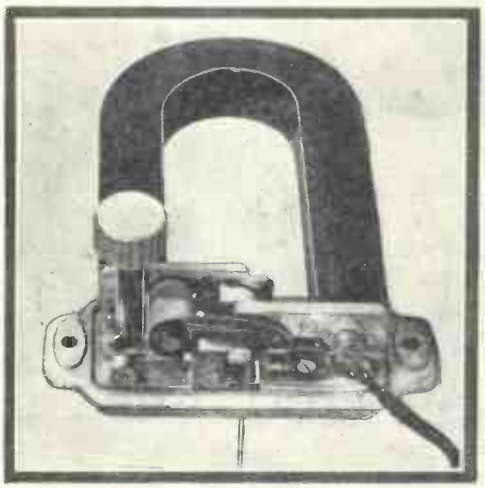
A SIMPLE CONE LOUD-SPEAKER

Anyone Can Build This Simple Instrument at Low Cost

Designed and Assembled by the "W.M." Technical Staff

OPINIONS differ as to what is the actual "best" loud-speaker; for the ordinary listener, however, who is satisfied with good reproduction of all notes excepting the lowest bass, it is generally admitted that there is nothing to beat the reed-driven diaphragm type of loud-speaker.

The most commonly used form of diaphragm is the cone. With this shape we obtain rigidity and light weight—two of the essentials of the successful diaphragm. Conical diaphragms in a variety of sizes can now be obtained ready-made—finished in artistic shades—at extremely low prices.



Photograph of reed driving unit used in the construction of the loud-speaker

Ready-made Cone

The loud-speaker described and illustrated in these pages has been designed to employ one of these ready-made cone diaphragms in conjunction with a balanced-armature loud-speaker unit, a view of the "works" of which is shown above.

Providing the specification as to parts is strictly adhered to, we are confident that readers who construct this loud-speaker will possess an instrument which will satisfactorily reproduce at good volume all that the finest receiver is capable of giving with the exception of the very lowest bass notes.

The bass drum, which is never heard properly when using an ordinary short-horn loud-speaker, is reproduced remarkably well on this instrument and gives an added interest to the musically inclined listener who has previously employed a horn loud-speaker of the non-exponential type.

Before proceeding with the constructional details, it may be mentioned that a full-size blueprint of the loud-speaker is obtainable at half-price (that is, 6d.) providing the coupon on page iii of the cover is dispatched to us before January 31. Address your inquiry to Blueprint Dept., WIRELESS MAGAZINE, 58/61 Fetter Lane, E.C.4; and ask for No. W.M. 111.

The blueprint is, of course, not absolutely essential, as a small-size reproduction is given in these pages, but the full-size print will be a valuable aid to the man who has not previously tried his hand at loud-speaker construction.

When the parts are at hand, the aluminium strip should be cut up into four 3-in. lengths and drilled and bent to the dimensions given in the lower right-hand corner of the blueprint (see opposite page).

The four diaphragm support clips—as they may now be termed—are to be clipped tightly to the "flap" of the buckram cone at four equally distant points, so that when the diaphragm, complete with clips, is placed inside the cabinet each clip will be located over one corner of the fretted front.

This is clearly seen in the open back view of the loud-speaker at the left-hand side of the blueprint.

Position of the Cone

Before screwing down the clips to the fretted front of the cabinet, the cone should be placed so that it is concentric with the design on the front.

When putting in the wood screws, two 4 B.A. washers should be placed under the head of each in order that the points of the screws will not protrude through and disfigure the front of the cabinet.

It should now be possible to move the cone backwards and forwards by a slight pressure of a finger on the apex; the sides of the diaphragm must not, however, rub on the inside of the cabinet or good reproduction will not be obtained when the loud-speaker is put into use.

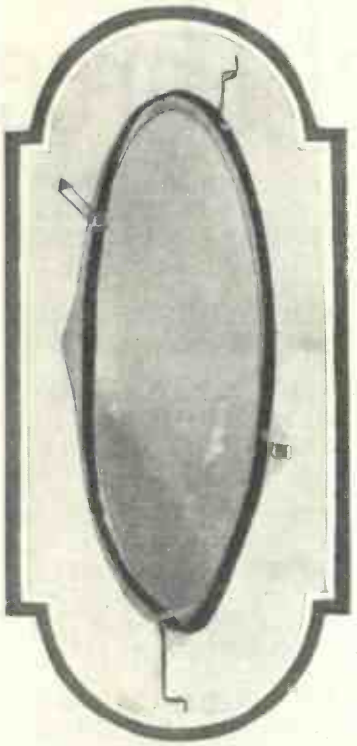
To complete the diaphragm assembly, a small hole should be pierced in

LIST OF COMPONENTS for the SIMPLE CONE LOUD-SPEAKER

1—Loud-speaker cabinet, 13 in. by 13 in. by 6 in. (Raymond).
1—Buckram cone diaphragm, 12 in. diameter (Raymond).
1—Cone loud-speaker unit (Blue-spot type 66K).
4—Diaphragm support clips (cut from No. 22 gauge aluminium strip, 12 in. by ¼ in.).
4—¼ in. No. 4 wood screws.
8—No. 4 B.A. brass washers.

the apex of the cone with a nail or other pointed instrument, so that the driving rod of the unit can be passed through it.

The unit itself is mounted on the back board of the cabinet; the centre-line of the driving rod should come approximately in the centre of the



View of cone with clips.

back board. Probably the best method of ensuring this is to draw two diagonal lines from the corners of the wood square—the point where the diagonals intersect will, of course, indicate the point opposite which the unit driving rod should come.

After firmly mounting the unit, a hole should be drilled in the back board to pass the connecting leads from the unit to the outside of the cabinet.

Conical Washers

Before fixing the back into the latter, one of the conical washers should be carefully removed from the driving rod of the unit; the remaining washer and nut should then be set at a distance of approximately one-third the length of the screwed portion of the rod from the unit end.

The back board, complete with unit, should now be placed near the back of the cabinet and the end of the driving rod passed through the hole previously made in the apex of the diaphragm; now push the back carefully towards the cabinet and fix it securely in position by means of the wood screws provided.

Tweezers

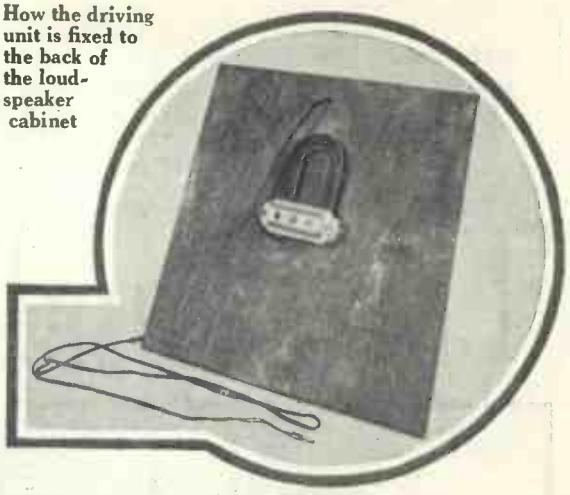
To complete the loud-speaker, place it front upwards on the table or bench while the washer previously removed is placed back over the end of driving rod projecting through the apex of the diaphragm. For this operation a pair of tweezers will be found very convenient.

Finally, the nut previously removed should be screwed into position on the rod over the washer This is rather a tricky job, but if the nut is first screwed on to the "point" of a blunt blacklead pencil so that the lead projects about half-way through the nut, it will be found a very simple matter to get the nut started on the thread of the rod; after which the pencil can be removed and the nut screwed down tightly on to the washer by means of tweezers.

Adjusting the Unit

The loud-speaker is now ready for use. One point which should be mentioned, however, is that when first testing the loud-speaker, the adjusting nut at the rear of the cabinet should be moved to the right or left as required, in order to centralise the armature.

How the driving unit is fixed to the back of the loud-speaker cabinet



All Those in Difficulty

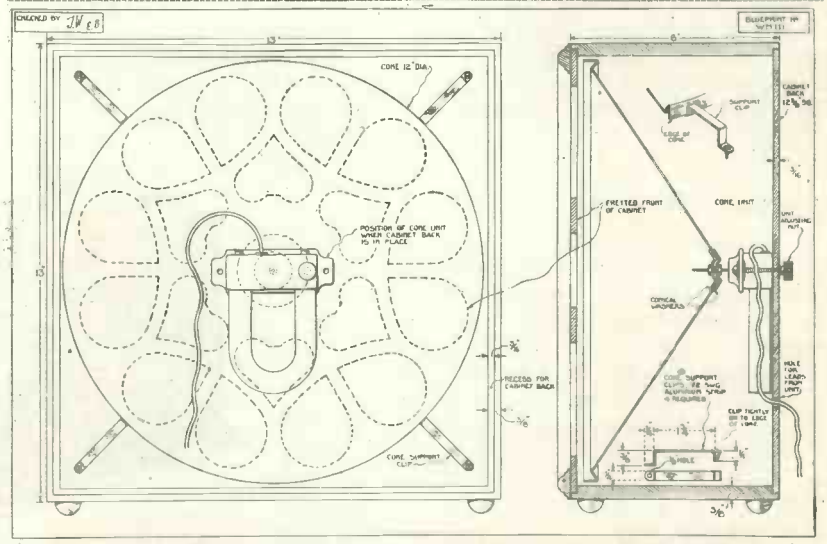
over any radio problem should avail themselves of the experience of the WIRELESS MAGAZINE *Technical Staff.*

If the coupon on page iii of the cover is used any two questions will be answered for a fee of 1s. *(postal order). Send also a stamped addressed envelope for the reply, which will be despatched within a few hours.*

The Information Bureau is unable to undertake the testing of readers' sets.

All enquiries should be addressed to:—

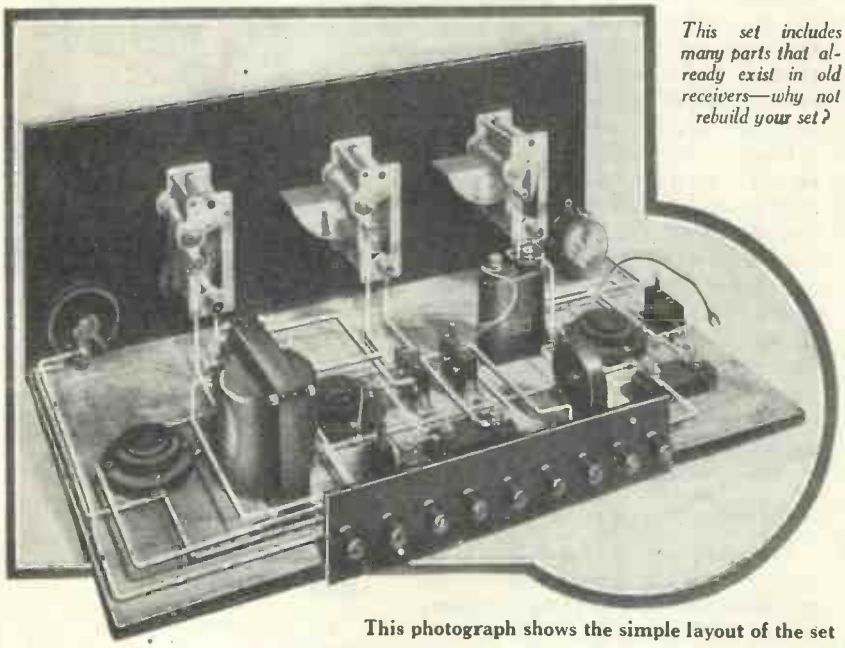
Information Bureau,
WIRELESS MAGAZINE,
58/61, *Fetter Lane, E.C.*4



This assembly 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 by January 31. Ask for No. WM111.

Here are details of a simple set employing ordinary two-pin plug-in coils which gives really extraordinary results with three-electrode valves. The circuit combination comprises a high-frequency amplifier, detector, and low-frequency amplifier. Adequate "punch" can be obtained from a large number of foreign stations. There is no difficulty about the construction or operation and the cost is low

The Standard-coil Three



This set includes many parts that already exist in old receivers—why not rebuild your set?

DESIGNED, BUILT AND TESTED BY THE "WIRELESS MAGAZINE" TECHNICAL STAFF

USES STANDARD TWO-PIN PLUG-IN COILS

NEUTRALISED THREE-ELECTRODE HIGH-FREQUENCY AMPLIFIER

EVERY CONNECTING WIRE NUMBERED IN ORDER OF ASSEMBLY

GOOD RESULTS EVEN WITH POOR AERIAL

PENTODE CAN BE USED IN LAST STAGE IF DESIRED

This photograph shows the simple layout of the set

IF the heart of a modern receiver is comprised of the valves used in it, then undoubtedly the tuning circuits comprise the lungs. The great importance of the tuner can be gauged even by the beginner by noting the large variety that is available. Many of these are special types that offer some particular advantage, such as covering an extended band of wavelengths.

Question of Expense

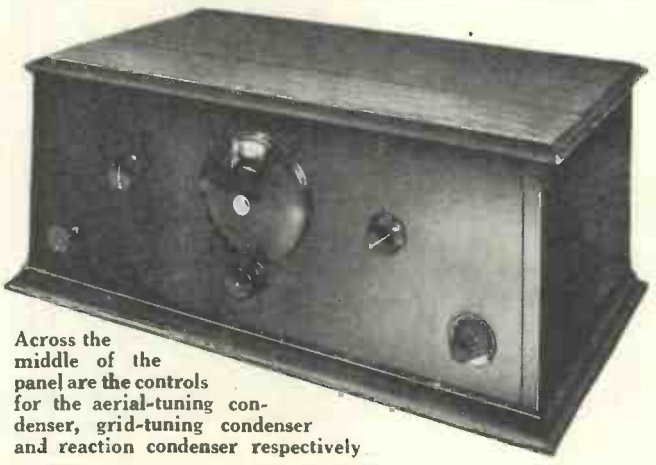
All of them, however, show to disadvantage compared with the standard two-pin plug-in coil when expense is taken into consideration. For the benefit, therefore, of those who must bring down the cost of their receivers to the absolute minimum—and also for those who have an old set on hand—we are describing in this article an up-to-date and extremely efficient three-valver which uses these coils in the best possible way.

Although the circuit includes only one L.F. amplifier (three-electrode and not a pentode), it does not lack "punch." In fact, at Kensington, on a small indoor aerial, Daventry 5GB comes in at really remarkable loud-speaker strength and, with a pentode in the last stage, Radio-Paris can also be heard on the loud-speaker. Tested independently near Watford on an outdoor aerial for a few hours, a large number of stations was received on the loud-speaker.

It is, of course, well known that ordinary plug-in coils are not particularly efficient in themselves—that is why W. James, our Research Consultant, developed the special type of Touchstone coil. But these are comparatively expensive and, as reaction is applied in the Standard-coil Three, the results obtained are exceptionally good for a set of its type.

Great Efficiency

For reception from distant stations, the Standard-coil Three is very much



Across the middle of the panel are the controls for the aerial-tuning condenser, grid-tuning condenser and reaction condenser respectively

more efficient than an ordinary set, comprising one detector and two low-frequency stages. It can be especially recommended to those who want the best possible three-valver (using standard coils and three-electrode valves) for use with an inefficient aerial-and-earth system.

Circuit Arrangement

The arrangement of the actual circuit is clear from the diagram reproduced on this page. In the aerial circuit is a double-tapped coil, giving the choice of two comparatively small tappings for use as a neutralising winding for the first valve.

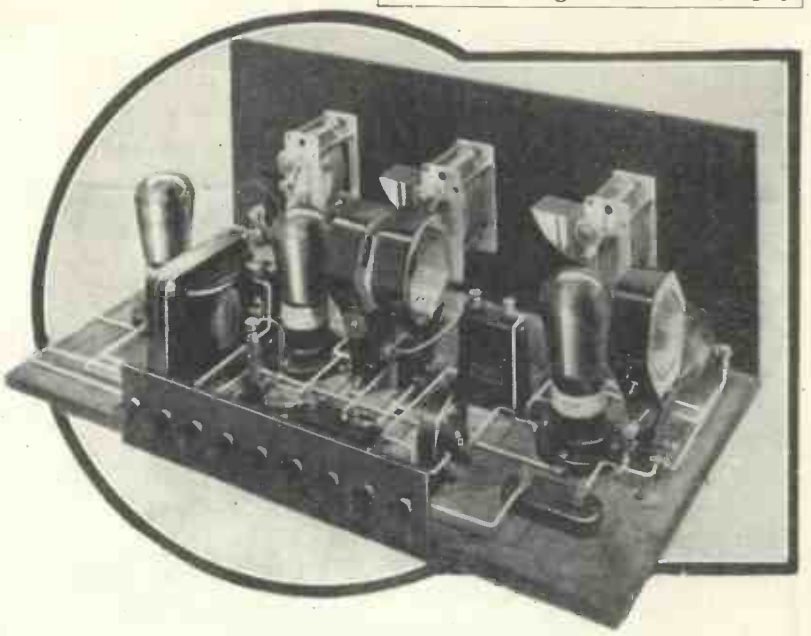
It will be seen that the whole coil is tuned by a .0005-microfarad variable condenser, and the whole of the voltage available across the coil is applied to the grid and filament of the valve. In the case of a No. 60 double-tapped coil there is a choice of 6 or 15 turns approximately for the neutralising winding, which is used in conjunction with a small balancing condenser, of 38 micro-microfarads capacity.

C.T. Coil Unsuitable

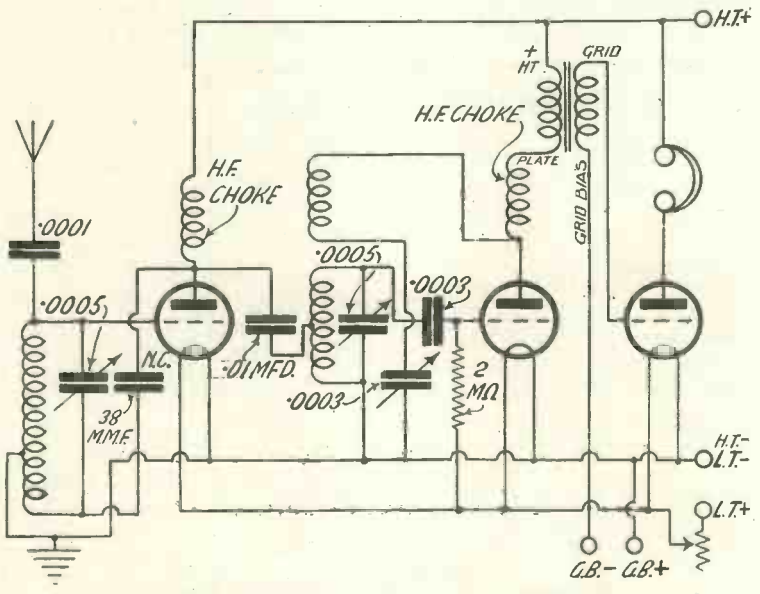
With most valves it will be found that the lower tap (that is, 6 turns) is best with the balancing or neutralising condenser nearly all in. In the case of a centre-tapped coil, the neutralising winding (which would be 30 turns with a No. 60 coil) would be too large.

The coupling between the high-frequency valve and the detector is a tuned grid coil. In the anode circuit of the first valve is a high-frequency choke to block the passage that way through the circuit and guide currents to the tuned grid coil through a coupling condenser.

Those who have a number of parts on hand will be interested to know that the value of this coupling condenser is not at all critical and can be anything from .001-microfarad upwards. As the grid of the detector valve, which is of the leaky-grid type, is insulated from the high-tension battery by the grid condenser there is no need for the anode coupling condenser to be specially chosen and a large-capacity Mansbridge type can be used if desired.



This photograph shows the Standard-coil Three all ready for use, with the necessary valves and coils in position. Note the L.F. transformer on its side.



This is the Circuit of the Standard-coil Three

Increased selectivity is obtained by using a centre-tapped coil in the detector grid circuit; this is tuned by another .0005-microfarad variable condenser. If desired, selectivity can be improved by using a double-tapped in this position, but this practice reduces signal strength. With a centre-tapped coil the set is remarkably selective.

Obtaining Reaction

The grid condenser and leak are of .0003-microfarad and 2 megohms respectively; values of .0002-microfarad and 3 megohms would be equally suitable. Reaction is obtained by coupling a coil in the anode circuit of the detector valve to the grid coil, the amount of oscillation being controlled by a .0001-microfarad condenser.

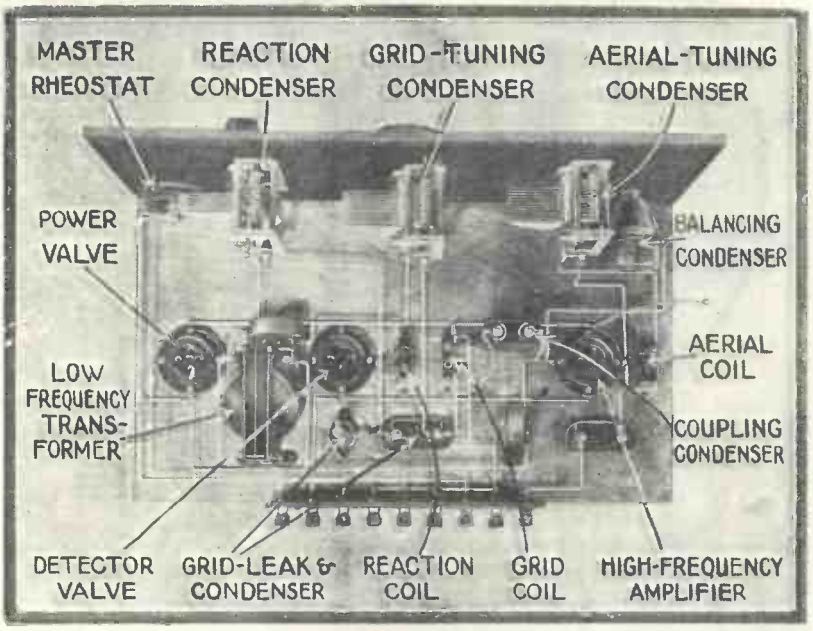
This method of obtaining reaction necessitates another high-frequency choke, in the anode circuit of the detector valve. The choke is therefore in series with the primary of the inter-valve transformer which couples the detector to the output valve.

Small By-pass Condenser

In the particular transformer used in the original Standard-coil Three there is a .0003-microfarad by-pass condenser across the primary. No trouble will be experienced on this account, however, provided of course that an efficient choke is used.

Grid bias is applied to the last

The Standard-coil Three (Continued)



This plan-view of the Standard-coil Three clearly shows the positions of all the parts. It will be seen that there is nothing difficult about the construction

valve and it will be observed that a master rheostat controls the whole set, while all the valve anodes are supplied with the same high-tension voltage.

The arrangement of the controls can be seen from the photograph at the bottom of page 548. Across the middle of the panel there are three controls—two small knobs and a slow-motion dial: these are for aerial tuning, detector-grid tuning and reaction respectively.

Balancing Condenser

In the left- and right-hand bottom corners are the balancing or neutralising condenser and the master rheostat, which is used as an on-off switch for the whole set.

Once it has been adjusted there is little need to touch the neutralising condenser again and the reaction control also needs little adjustment when the set is used on an ordinary aerial. It is needed when only an indoor aerial is available.

In obtaining the parts for this receiver, particular care should be taken to get efficient high-frequency chokes as these control the efficiency of the set to a large extent. Any reputable make of two-pin plug-in coil can be used, provided that they are tapped from the "socket" end and not the "plug" end. The same remark applies also to the low-frequency transformer. A Ferranti AF3 is so efficient, by the way, that if the set is used on a mains-supply unit "motor-boating" will occur unless special precautions are taken.

Blueprints Available

The set is not difficult to construct, especially if a full-size blueprint is used. This can be obtained for half-price (that is, 6d., post free) only if the coupon on page iii of the cover is used by January 31. Address your inquiry to Blueprint Dept., WIRELESS MAGAZINE, 58/61 Fetter Lane, E.C.4; and ask for No. W.M.117. A blueprint is not, of course, absolutely essential, for all the necessary details are reproduced in these pages.

Assembling the Set

There are only five holes to be drilled in the front panel, for the mounting of the four variable condensers and rheostat. As soon as these have been fixed into position, the panel should be screwed to the baseboard and the rest of the components screwed down on the latter. This operation will present no difficulty if the photographs and blueprint (or the reduced reproduction opposite) are consulted.

As soon as all the parts have been fixed into position, wiring up can be started. This will be no trouble at all if the blueprint is used as each wire is numbered and it is necessary only to connect up in order, crossing through each number as the connection is made. In this way the wiring is built from the baseboard upwards in the most efficient way. Even if you can read a circuit diagram easily, the blueprint will save you time in wiring. Note that wire No. 8 is provided with a spade tag at one end.

Suitable Valves

Before the set can be used, suitable

COMPONENTS REQUIRED for the STANDARD-COIL THREE

1—Ebonite panel, 18 in. by 7 in. (Becol, Keystone, or Trolite).
2—.0005-microfarad variable condensers (Trix, Lissen, or Utility).
1—.0003-microfarad variable condenser (Trix, Lissen, or Utility).
1—15-ohm panel rheostat (Lissen, Peerless, or Igranic).
1—Micro condenser for panel-mounting (Igranic).
1—Slow-motion dial (Lissen, Igranic, or Burndept).
3—Single-coil holders (Lotus, Peto-Scott, or Magnum).
3—Anti-microphonic valve holders with terminals (Lotus, W.B., or Formo).
1—.0001-microfarad fixed condenser (Dubilier, T.C.C., or Trix).
1—.0003-microfarad fixed condenser (Dubilier, T.C.C., or Trix).
2—High-frequency chokes (Burndept, Magnum, or Lewcos).
1—.01-microfarad fixed condenser (Dubilier Mansbridge type).
1—2-megohm grid leak with holder (Dubilier, Mullard, or Ediswan).
1—Low-frequency transformer (Ferranti A F 3, Igranic, or B.T.H.)
1—Terminal strip, 9 in. by 2 in. (Becol, Keystone, or Trolite).
9—Terminals, marked: — Aerial, Earth, L.T.+, L.T.—, H.T.+, G.B.+, G.B.—, L.S.+, L.S.— (Belling-Lee or Eelex).
1—Cabinet with 10-in. baseboard (Artcraft).

An Extraordinarily Efficient Receiver

valves must be chosen; this is a simple matter as the circuit is not at all critical. Two high-frequency valves and a power valve are needed. The high-frequency valves (for use in the first two positions) can have an impedance in the neighbourhood of 20,000 to 30,000 ohms.

Impedance Lowered

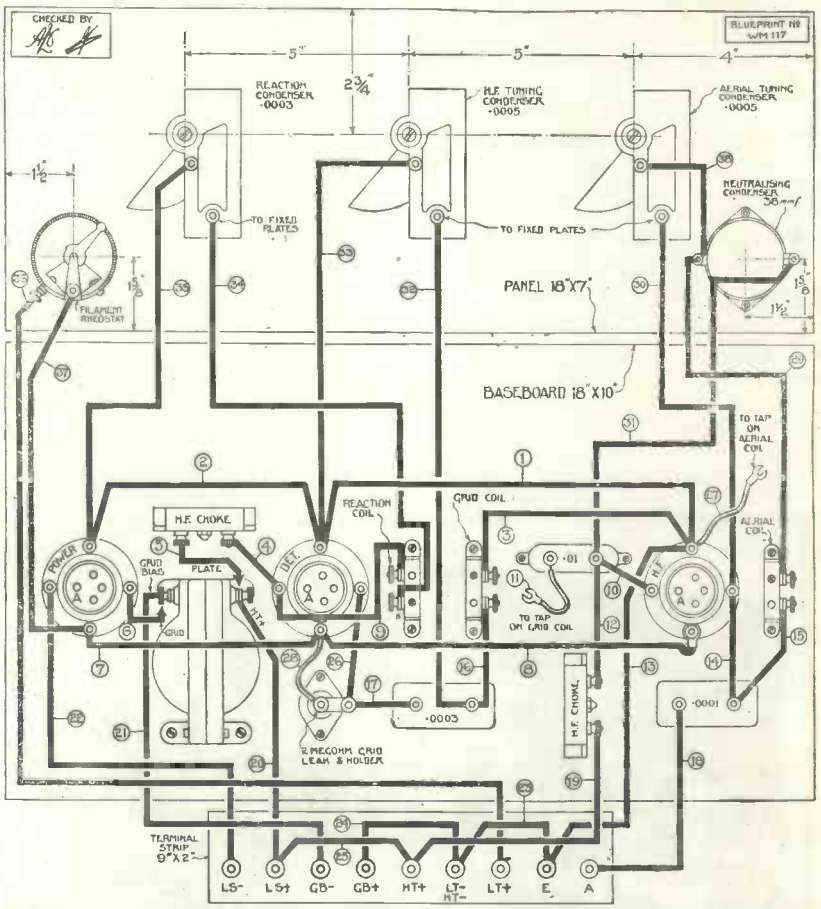
The fact that the grid return of the detector is taken to low-tension positive means that the effective impedance of the valve is reduced and one with an impedance as high as 60,000 or 70,000 ohms can be used quite successfully if desired.

In the case of the power valve, choose one with an impedance between 2,500 and 4,000 ohms. A value below 2,500 ohms is too low for use with the average loud-speaker. See the complete list of valves on pages 516-7.

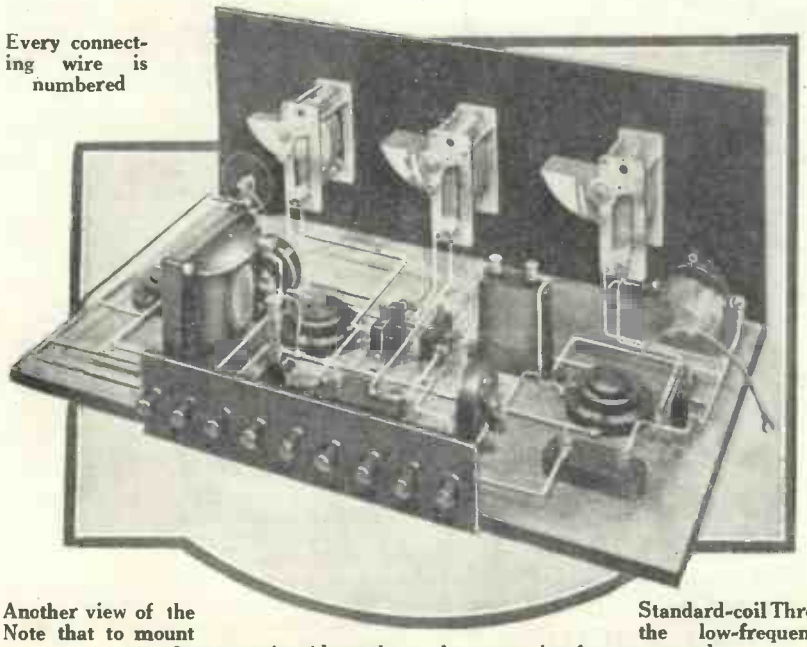
Tapped Coils

It has already been mentioned that the coils must be tapped up from the "socket" and not the "plug" end, otherwise the holders on the baseboard for the aerial coil must be reversed, or it will not be possible to neutralise the high-frequency valve. Coils to use are :—

Low Waves: Aerial, No. 60 double-tapped; Grid, No. 60 centre-tapped



This layout and 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 by January 31. Ask for No. W.M.117



Every connecting wire is numbered

Another view of the Standard-coil Three. Note that to mount the low-frequency transformer on its side as shown the supporting feet are moved

Reaction, No. 45 (approximately).

Long Waves: Aerial, No. 200 double-tapped; Grid, No. 200 centre-tapped; Reaction, No. 100 (approximately).

To test the receiver, insert the necessary valves and coils in the appropriate holders. The tappings to the aerial and detector-grid coils should be connected. To H.T.+ apply 120 volts and to G.B.— the bias recommended by the makers of the power valve used, usually from 9 to 18 volts. Note that H.T.— is connected to L.T.—.

Operating the Receiver

Now turn on the master rheostat 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. Rotate the slow-motion dial of the grid-tuning condenser, at the same time swinging the small knob of the aerial condenser backwards and

The Standard-coil Three (Continued)

forwards until a station is picked up.

The system of tuning is to adjust grid-tuning condenser critically, as its reading remains constant on any aerial, and to swing the aerial condenser afterwards until the desired station is heard. Then reduce the reaction as far as possible.

Neutralising the H.F. Valve

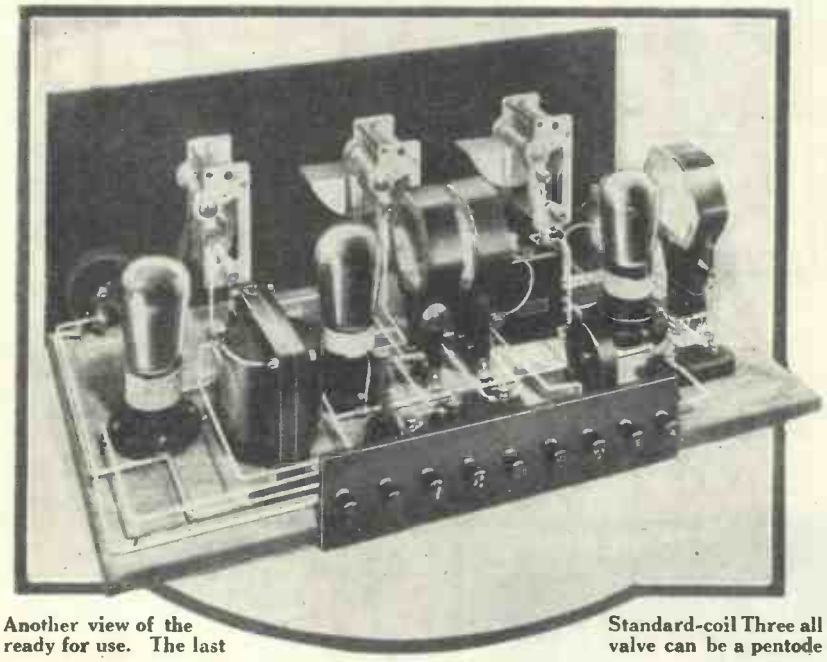
When a powerful station has been picked up try neutralising the high-frequency valve. To do this remove the spade tag attacked to wire No. 8 from the terminal on the first valve holder, so that the valve is switched off, but do not remove it from its holder.

Signals will still come through, proving that energy is passing from the grid to the anode circuit through the condenser formed by the valve electrodes. Carefully adjust the balancing condenser until no signals come through. This will occur when an equivalent amount of energy passes from the anode to the grid through the balancing condenser, as passes from the grid to the anode through the valve capacity—in other words, the valve capacity has been neutralised and the grid and anode circuits are no longer coupled by capacity. Oscillation does not occur in the high-frequency circuits, and the whole set is therefore stabilised.

If neutralisation cannot be obtained at any setting of the balancing condenser, try altering the tapping on the aerial coil. Whenever the aerial coil is changed, it is necessary to re-neutralise the set.

Although with a normal outdoor aerial signals are quite loud enough with an ordinary power valve, a pentode may be advantageous with a poor aerial. We have successfully used a Mullard PM22 in the set and found signal strength to be considerably increased.

If a pentode is to be used permanently, a 10,000-ohm resistance should be inserted in the lead from the auxiliary grid terminal on the valve base and H.T.+. The voltage drop introduced by this resistance will be of the order of a few volts only.



Another view of the Standard-coil Three all ready for use. The last valve can be a pentode

We believe that the Standard-coil Three is one of the most efficient sets of its type the WIRELESS MAGAZINE Technical Staff has ever designed. It is more selective and has greater range than the normal three-valver, while the volume leaves little to be desired. Anybody who builds the set will be pleased with it, and we shall be glad to have readers' opinions.

NOW READ WHAT CONSTRUCTORS HAVE TO SAY ABOUT OTHER "W.M." SETS—ON PAGES 573 AND 574

Some Questions Answered

By the Information Bureau

Position for Milliammeter

Q.—I have purchased a milliammeter for testing purposes and have connected it in series with one of my loud-speaker leads to determine how much current I am drawing from my H.T. battery, but I am sure something is wrong because, using three valves, including one power valve, the meter only registers 5 milliamperes. Can you tell me how the meter should be connected?—J. K. (Leeds).

A.—When connecting up the meter in series with one of your L.S. leads, it only registers the amount of current being passed by the last valve in circuit. It will also indicate distortion when the receiver is working, for when the needle flickers distortion is present, but when the H.T. and G.B. voltages are adjusted until the needle remains stationary and signals are being received, then no real distortion is present.

To measure the total current demanded from the H.T. battery, the meter should be connected in series between the negative H.T. terminal on the set and the negative H.T. wander-plug to the battery.

Capacity v. Magnetic Reaction

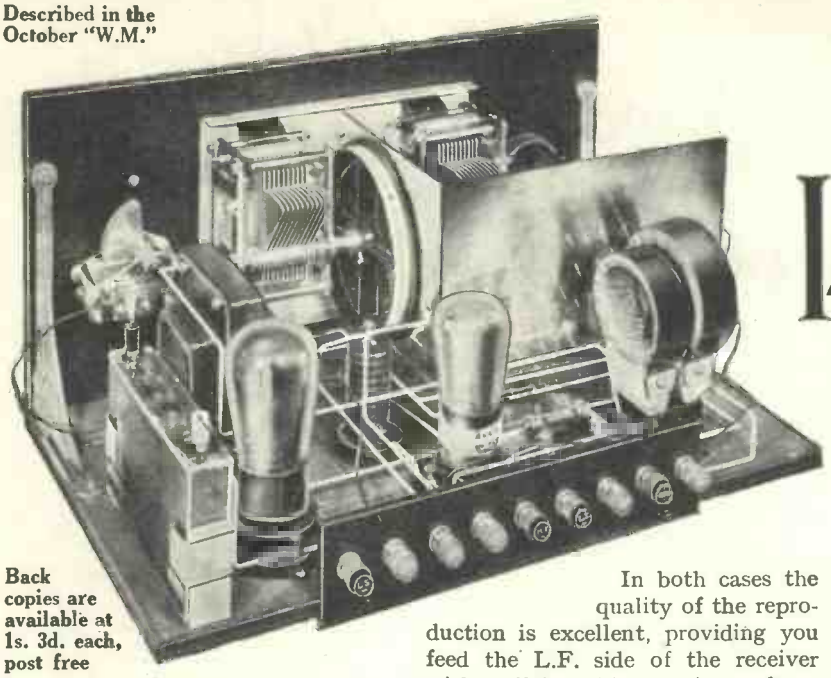
Q.—I have just completed the construction of a Reinartz set, detector and two L.F., and on test this set brings in far more distant stations than my earlier set, which makes use of magnetic reaction. Thinking that the older set had developed some faulty connections, I re wired completely, but even now I still cannot obtain the same satisfactory results as with the Reinartz set.

I have also tried substituting parts in the two sets, but all components appear to work quite satisfactorily. Can you suggest what is preventing my getting distant stations on the magnetic reaction set?—T. R. (Barnes).

A.—Your experience is quite common, and is due to the fact that the magnetic reaction control is not nearly so smooth as the Reinartz (capacity-controlled) reaction. The smoothness of reaction control permits tuning the receiver much nearer to the oscillation point without the set breaking into and maintaining self-oscillation, and a receiver adjusted on the point of oscillation is capable of picking up distant stations with ease.

In most present-day straight circuits the capacity control of reaction is advocated, as this is so much more efficient for D.X. work than the older system of reaction—other considerations being equal as regards efficiency.

Described in the October "W.M."



Back copies are available at 1s. 3d. each, post free

The Inceptor 3

RESULTS OF AN EXTENDED TEST by J. GODCHAUX ABRAHAMS

ALTHOUGH other up-to-the minute circuits have been published in the WIRELESS MAGAZINE, the Inceptor 3 has not only withstood the competition, but by a further and more exhaustive test has proved itself one of the best receivers it has been my pleasure to use.

Increased Selectivity

I have experimented with it for over a week and, with the slight alterations suggested in the last paragraphs of the article dealing with this receiver on page 315 of the November issue, the selectivity of the circuit has been considerably improved, with the result that at these sittings I have been able to pick up a much greater number of stations.

Owing to my proximity to the London aerial, the adoption of a double-tapped instead of a single-tapped coil in the case of stations working on a wavelength somewhat unpleasantly near to that of 2LO has been of considerable help.

Strength Overpowering

Again, as a screened-grid valve is incorporated in the circuit, if selectivity is to be achieved an aerial on the *short* side must be used. Even then, believe me, for your local station you may have to replace the pentode by an ordinary super-power valve. In my home the strength of the 2LO transmission is overpowering.

In both cases the quality of the reproduction is excellent, providing you feed the L.F. side of the receiver with sufficient high-tension voltage and correctly adjust the grid-bias battery.

Tuning you will find critical, especially that of the anode condenser; the gearing appears to be just right, but your touch on the thumb control must be light, or you will miss many broadcasts. A slight movement of this condenser will cut out an unwanted transmission and bring in another carrier wave; then careful adjustment of the aerial and reaction condensers will boost it up to the desired volume.

Personally, as a rule, for accurate logging, I first work over the scale while using headphones; then, having noted the condenser readings of each "capture," it is an easy matter to switch over to the loud-speaker. For headphones, be careful to use a low-power L.F. valve only, as a super-power or pentode would prove dangerous to your hearing.

From experience, I *know*; you may believe my statement without

(*Continued on page* 570)

FURTHER TEST REPORT OF INCEPTOR 3

SHORT WAVES

Coils used: No. 40 (double-tapped): and No. 60 (double-tapped): Reaction 35.

Wavelength in Metres	*Station*	*Condenser Readings Aerial*	*Anode*
242	Nuremberg	30	32
250	Muenster	33	34
268	PTT Lille	40	42
279	Kaiserslautern	44	46.5
283	Cologne	45	47
*298	Hanover	51	55
*306	English station (Belfast?)	54	57.5
319	Dublin	58	62
322	Breslau, heterodyned by French station, believed to be Radio Vitus, Paris	60	63
*337	Copenhagen	62	65
340	Huizen (during day)	64	65
349	Prague	67	68
361	2LO London	72	72
379	Stuttgart (badly heterodyned)	78	79
389	Radio Toulouse	82	85
396	Hamburg (heterodyned whilst Toulouse working)	85	87
398	San Sebastian (when Hamburg closed down)	86	87.5
*409	Berne (?), faint	97	99
416	Goeteborg	106	108
422	Kattowitz	110	112
429	Frankfurt	112	114
434.8	Madrid (EAJ7), when Frankfurt closed down	114	116
449	Rome	118	122
*458	PTT Paris	120	124.5
470	Langenberg	124	128
491	Daventry 5GB	132	136
508	Brussels	136	140
517	Vienna	140	145
*536	Munich	148	152
547	Milan	150	158
555	Buda-Pest	155	160
*580	Ljubljana (faint, but identified by interval signal)	170	175

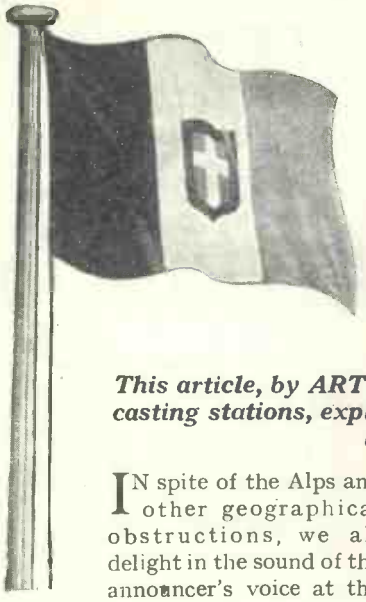
LONG WAVES

Coils used: No. 200 (centre-tapped): Reaction 60–75.

Wavelength in Metres	*Station*	*Condenser Readings Aerial*	*Anode*
*1,000	Leningrad (?)	54	60
1,071	Hilversum	60	65
1,111	Warsaw	68	75
1,153.8	Kalundborg	72	79
1,250	Berlin (Konigswusterhausen)	86	88
1,363	Motala	94	98
*1,522	Lahti (?) faint	104	110
1,562	Daventry (5XX)	110	115
1,649	Berlin (Zeesen)	116	112
1,765	Radio Paris	132	138
1,852	Huizen	148	150
1,950	Scheveningen-Haven	164	160

Stations marked with an * were only heard on headphones, other broadcasts ranged from medium to full loud-speaker strength with pentode valve. For headphones, the last valve was replaced by super-power valve. Tests were carried out over a period of one week, as on some evenings atmospherics prevented the identification of more distant transmitters.

J. GODCHAUX ABRAHAMS.



Where Actors are Forced to Broadcast!

This article, by ARTHUR G. ALLAN, who has recently made a tour of European broadcasting stations, explains conditions in Italy, where any actor or singer can be forced to broadcast if the authorities so desire

IN spite of the Alps and other geographical obstructions, we all delight in the sound of the announcer's voice at the Milan and Rome stations, in fact, it was these same voices—of the female variety—that decided my visit to the Italian broadcasting headquarters in Milan.

Head Offices in Milan

For although the legal seat of the "Ente Italiano Audizioni Radiofoniche," the official name of the Italian broadcasting company, is situated in Rome, the head offices and general management are in Milan.

You will forgive me, I am sure, if, in the course of this brief article, I only refer to the above-mentioned company by its initials, "E.I.A.R." —the Editor would otherwise not leave me sufficient space for more important words.

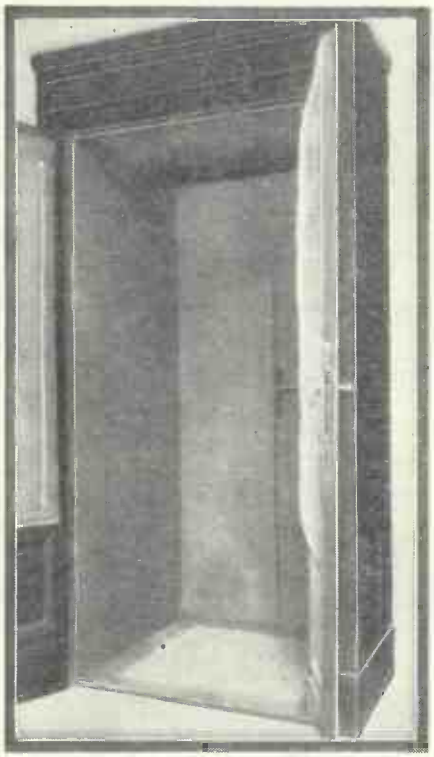
In reply to an inquiry, I received a letter in 1925 from the former broadcasting organisation, in which I was informed—at the time there was only the Rome station in operation—that "Italian broadcasting first appearance on October 6, 1924," that "licence need absolutely to listen in," that this same licence cost 80 Italian liras per year and that the number of licences amounted, in February, 1925, to about 200,000.

More Stations Opened

This gives a better idea of the beginnings of broadcasting in Italy than I could have set out. Further stations were opened in Milan at the end of 1925, in Naples in 1926, a stronger station in Milan in 1927, and this brought the development under the old arrangements to a close.

Several commissions investigated and reviewed Italian broadcasting during 1927, when it was decided to completely reorganise from January 1, 1928, onwards. A new company, the E.I.A.R., was formed and a host of new laws passed.

NOT A PADDED CELL!



Sound-proof entrance to the Milan studio

Ing. Chiodelli, the Managing Director of the E.I.A.R., was kind enough to set out for me the most important changes, which comprise taxes and voluntary contributions. Then Count Besozzi showed me the head offices and the Milan station situated in a house not far away.

The transmitter (Marconi) is situated at Bigentino, about 4 miles from town; the studios, however, are in the centre of the older town. To reach these you first pass through one of these typical Italian gardens surrounded by the house (it is very quiet and restful), then through another gateway and into a newer building where on one floor are the Milan station offices and the speech studio, and on the floor above the large studio hall and control room.

Programme Director

Here I was introduced to Maestro Parelli, the Programme Director of the Milan station. He is a musician and composer of no mean standing and has lived in our own country for years. A queue of people were waiting outside to see him, but on hearing where I came from he granted me ten minutes of his valuable time and gave me a condensed version of his views on how a broadcasting programme should be made:

"Always give the best you can, be it Children's Hour or studio performance of Grand Opera. Remember that the general listener (Italian, of course) is naturally very fond of music and that the most popular item will always be music and opera, but also do not forget that your listener may not be able to understand the most difficult music at the very beginning, so start with easy things and slowly train his ear and taste and raise the standard. But always have the very best artists obtainable.

Composers to Conduct

"When transmitting modern opera or generally works by musicians that

are still among the living have the composer in the studio conducting the orchestra—only then will you be sure of having given the right interpretation of the work. This is especially necessary when producing works by the youngest composers, as they are so often misunderstood owing to some older man of another school not giving the author's interpretation."

Compositions for Broadcasting

Here I struck on Maestro Parelli's weak spot. He told me he had so often been misunderstood in his youthful compositions that he encouraged the young composers to write for him, that is, for broadcast performance and helped them to actually express what they had thought when composing, taking into consideration the musical understanding of our day.

He then talked enthusiastically of the Milan station orchestra, a body of some sixty musicians which he had formed into one of the best orchestras in the land.

His Opinion of Jazz

I then asked what he thought of jazz. Here he told me that it figured in the programme as listeners wanted it, but if all listeners were like himself, a law would be passed in Italy prohibiting the performance of any and every kind of jazz music.

It was time I left him to his other visitors and we were soon out on the sunny street again. Slowly returning to the offices, Count Besozzi told me of the law which had recently been passed in Italy forcing every performer, actor, or singer, to appear before the microphone if so required by the broadcasting authorities, and at a fee which is fixed by an independent committee!

Best Talent in the Land

In this manner the very best talent in the land can be forced, if necessary, to broadcast. In one case in Milan this is especially apparent, as up till now the famous Milan Scala Opera could never be heard "on the air" for some reason or other, but this coming season listeners far and near will be able to enjoy the opera performances from that world-famous opera house.

From the above it may seem that Italian programmes are mostly of the musical variety. Well, this is mainly the case where the grand evening entertainment is concerned, but at other times, talks on everything under the sun, plays and all the other features of a good broadcast programme are not missing, including numbers of relays from different sporting events.

Count Besozzi told me of the exciting relay from a motor-boat race on the lake of Como not far from Milan, where he had several times nearly, but not quite, had to swim out of a watery grave and where the poor microphone had had more to drink than was good for it.

Best Organisation?

The Italians certainly have the necessary enthusiasm for broadcasting and with the new financial and administrative basis this year there are the greatest possibilities for Italy soon having the best broadcasting *organisation* on the continent.

Count P. Besozzi of the Ente Italiano Audizioni Radiofoniche

"Matching" Detectors and L.F. Stages

WHEN making a choice between the anode-bend and leaky-grid systems of rectification, amateurs are usually swayed only by consideration of the detector valve. It is generally known of course, that the grid leak and condenser method is the more efficient from the point of view of sensitivity, while anode-bend is invaluable when it is required to obtain the optimum purity from a station giving considerable grid input swings.

It is frequently forgotten that the system of detection employed has a distinct bearing on the L.F. stage immediately following the detector. The transformer for the first L.F. stage should, of course, be chosen with careful regard for the impedance of the detector valve, which it has to match, and this impedance is in turn governed largely by the grid circuit arrangements.

Anode-bend Impedance

The impedance when anode-bend rectification is employed may be several times that obtaining when the leaky-grid system is used—the reason being that with the latter system the grid voltage is lower and the anode voltage correspondingly higher. The moral, of course, is to decide on the method of detection before purchasing components for the L.F. side of the receiver.

B. LYNCH.

Is Your H.F. Choke "Safe"?

MANY people, when purchasing an H.F. choke, favour the methods adopted by gentlemen acquainted with horseflesh, and judge by looks alone! True, it is possible to judge the efficiency of a choke by the amount of wire apparently in circuit, but a more accurate indication of the "safety" limits of a choke for use in a particular circuit are called for in many cases, more especially when it is known that the choke will be required to work at near its upper or lower wavelength limit.

It is, nevertheless, an easy matter to test a choke, and the following simple trial is frequently well worth while. Rig up a simple single-valve reaction circuit, or, if possible, utilise the detector portion of an existing set. Tune to the "doubtful" wavelength limit of the choke to be tested, and adjust the circuit until it is oscillating freely. This can best be ascertained by wearing phones and noting if the loud "plonks" denoting oscillation are obtained when a finger is placed on the grid terminal. Then insert the choke in series with the phones and note if it is still possible to make the circuit oscillate at that particular frequency. Absence of oscillation is a certain guide to the functioning of the choke. If a wavemeter is available it is, of course, an easy matter to check up the exact maximum and minimum safety limits of any choke.

T. L.

Beware of Terminal Corrosion!

THE terminals of the insulated wires which are attached to the positive and negative poles of an accumulator may become responsible for the loss of electric current, or

Fig. 1.—Greatly magnified view of the surface of a terminal which is in use on an accumulator. The minute grains are compact, firm, and clear yellow

produce defects in other directions if they are allowed to corrode, or "burn."

When they are new, clean, and bright, all goes well; but being composed of brass they are liable to acid attack and minutely serious spoliation.

"Creeping" Acid

The acid "creeps" slowly upwards as thin films closely adherent to the internal surfaces of the accumulator; and thus contacts with the metal.

It is not generally known that sulphuric acid has the faculty of drawing atmospherical moisture to itself; it will, within two or three months of *isolated* exposure, become twice, or thrice, as heavy as was its original weight.

Continuous Passage

Thus, it is obvious that, however narrow any channels of communication are which exist between an accumulator and the air, there is a continuous passage of vapour into the vessel; its film sucking up the acid to the metals, although the acid bulk may dwindle, meantime.

Simultaneously, the ordinary electrolysis of the accumulator plates proceeds apace, thus contaminating the liquids concerned. Solution of lead-sulphate in this way mixes with solution of copper-sulphate.

There is no such compound as *brass*-sulphate; and it is the copper content of this yellow metal which yields the greenish salt copper-sulphate; the zinc content being far less conspicuous.

Bronze Terminals

The same remarks can be applied to bronze terminals; except that in this case the white metal compounded with the copper is tin.

As the dilute sulphuric acid "eats" the terminals, it converts the metal into a bright green salt, or grit, if no room dust is upon it; or else a dull, dark green one if it is thus contaminated.

This salt, because it stands up above the general surface of the brass, and is granular, is often responsible for so gripping the terminal that one has difficulty in unscrewing it.

Grit-spots

Such grit-spots interfere with the proper passage of the electricity, as chemical salt is non-conductive; and even if they are scraped off, tiny pits, lined with useless films, exist.

Fig. 3.—Greatly magnified view of the edge, sideways, of a terminal at the point where it contacts with an accumulator screw; showing "glassy" salt crystals due to corrosion

It is much better to prevent their formation by keeping the metal polished and greased *very* slightly with vaseline. This will avoid many defects in reception which are often attributed to other causes.

Fig. 1 shows the surface of a clean, bright, terminal, largely magnified. Fig. 2 shows a portion of the muddy looking crust formed by admixture of ferric oxide from the steel screws with copper sulphate.

Fig. 2.—Greatly magnified view of the corroded surface of a terminal, being a relief crust of blackish green hue comprising a naked eye-view. Some parts are hard and dense; others loose

Fig. 3 shows a speckled, sulphatic-crystalled portion, which the naked eyes observes as brilliant specks, especially in sunshine on strong light.

Each particle obstructs thousands of electrons; and distorts the current.

J. Scott.

GRID-LEAK POSITION

IN sets having grid leaks for the H.F. and detector valves connected between the grid and one side of the L.T. supply it is rather important to keep the grid leak and condenser close to the grid socket. The position of the condenser is very frequently determined by the position of other components, and for convenience it is usually placed near the holder of the valve concerned.

The reverse is the case with grid leaks, however, and in quite a number of amateur-built sets it is common to see one tag of the leak soldered direct to the positive L.T. terminal, for example, and a long lead trailing round the set to reach the grid socket.

This is quite contrary to the best practice for it means that the minute impulses in the grid circuit are liable to be affected by the much stronger impulses in the anode circuits of other valves.

B. Marshall.

How to Recognise Those Foreign Stations

By J. GODCHAUX ABRAHAMS

THE broadcast licence holder who listens solely to his local station can only be compared to a man who lives in a house possessing but one window. Radio should give us a broader outlook; it can widen our horizon.

No Shut-in Feeling

With a multi-valve receiver in our possession we do not get that shut in feeling; we are not solely dependent on the wireless entertainment provided for us by our local transmitter, but at our sweet will may roam over Europe, and visiting in turn distant lands, may sample for so long as we please the concerts and performances given to their nationals.

In this year of grace, the happy possessor of a good radio receiver has the world at his elbow; for, comfortably seated in his arm-chair, he may select from a large number of home and foreign programmes any items to suit his varying moods.

At odd times when twirling your condensers you cannot have failed to pick up wireless transmissions; possibly hearing a song, or a performance by an orchestra, you may have held the wave for some time, yet although the entertainment pleased you, it was annoying to discover that you were not able to identify the transmitter from which the particular item was broadcast.

Unable to Label Stations

Many listeners are inclined to believe that because they do not possess even a smattering of foreign languages, they are precluded from labelling the continental broadcasts picked up on their receiver. Although it is true that a knowledge of French, German, Spanish, and other tongues considerably facilitates the task of identification, so many stations today have adopted individual signals that a little attention paid to the peculiarities of the studio in most instances will readily solve the puzzle.

Almost every possessor of a valve set must know the range of the coils he is using at the time, and consequently, without hesitation, can classify a transmission in the short-, medium- or long-wave broadcast band. In this manner, by comparison with the condenser readings of known transmitters, it is possible to broadly establish the wavelength on which an item of a programme is heard.

Use of Wavemeter

This can be done either by means of a graph, or a simple arithmetical calculation sufficiently accurate to give a rough estimate or, if the listener can gratify his ambition, by the aid of a calibrated wavemeter—the best of the three methods (see another page of this issue).

Generally speaking, however, all that we need is an estimation of wavelength, which allows us to narrow down the identification of a transmitter to a choice of some five or six stations. If we can place our broadcaster in this relatively small corner of the waveband, other details at our disposal will give us all the clues we require for naming the transmitter.

Apart from an actual call which we may or may not pick up, fortunately for the lesser experienced listener, during the last twelve months, foreign studios have more and more encouraged the adoption of interval signals sent out between items. Although a number of them have favoured the ordinary metronome, many stations showing more initiative now use mechanical or electrical sound devices furnishing specific signals easy of identification, and which once heard cannot be forgotten.

Classified Stations

In order to facilitate matters, for the benefit of the less experienced ether searcher, I have made an attempt to classify the stations adopting such signals under different headings, and in the tables annexed, you will find lists of the individual transmitters, using say, either bells, gongs, metronomes, or other mechanical devices to make themselves known to their hearers.

It must be borne in mind, however, that many studios use more than one kind of signal to announce themselves, as for instance Hamburg, which has adopted both morse letters and a gong; in such cases you will find these stations included in two or more tables. In other instances these automatic devices are only used at the beginning of a programme to preface a transmission; these have also been enumerated.

Metronome Signals

For some time, as already stated, the metronome has been a popular instrument, and has found favour with many studios. Fortunately however, its beat being variable, all stations do not adjust it to the same speed. The tick-tock of this instrument will be picked up many times in the course of one evening, but if

How to Recognise Those Foreign Stations *(Continued)*

the beats be counted, for some fifteen or thirty seconds, and the table consulted, it will be possible to trace from which broadcaster the transmission emanates.

As previously explained, these indications must be taken in conjunction with the data establishing an approximate wavelength, for it is obvious that although we might hear two identical types of metronome, there should be no confusion as regards the identity of the station if we know that one is on about 250-300 metres and another on a higher portion of the waveband.

Sir Barry Jackson, theatrical producer

Although as complete a classification as possible of these signals has been attempted, it has been found impracticable to include certain transmitters which have adopted characteristic signals peculiar to themselves only.

Cuckoo Calls

Ljubljana (Laibach), the new Jugo-Slavia station, is the only one broadcasting during intervals the call of the cuckoo—a sound which must be familiar to everybody, and Radio Montpellier, a small private transmitter in the South of France, opens its programme with the song of the nightingale, reproduced by a gramophone record.

Then again, from Munich and its sub-stations, when they are relaying the Bavarian capital programme, you will hear a regular sound—a metronome in style—but similar to a small hammer hitting two slats of wood; as a general rule this is followed by a short hoot (a deep G note).

Prague (Czecho-Slovakia) possesses no speciality, apart from its call with which it usually combines the native names of Brunn and Pressburg. Allo ! Braha, Brno, Bratislava, but its time signal is a colourable imitation of our own "six pips."

French Methods

Eiffel Tower (Paris) prefaces its programme by the slow enumeration, in French, of seconds counted by the announcer, and Petit Parisien invariably gives out its call in both French and English, and at the end of the transmission states the date and time of the next broadcast in both languages.

Although from France, as a rule, you will hear the "Marseillaise" played at the end of the day's programme, several of the provincial stations have taken melodies with which they are locally or historically associated.

Military March

From Radio Toulouse, a short military march, "La Toulousaine," is broadcast as the studio goes off the air; from Marseilles, a few bars from Bizet's incidental music "L'Arlésienne"; Bordeaux-Lafayette (PTT) closes down to a hymn, "Se Canto que Canto," and Nimes to a short patriotic song entitled "Les Allobroges."

At Madrid (EAJ7) the piano, for the time being, is called upon to open the evening transmission; from this station you may recognise Siegfried's bugle call from Wagner's famous opera; Stockholm and Goeteborg on the other hand start the evening with a short Swedish folk song played on a spinet.

Finally, where some doubt might exist as to the identity of a station, in some instances it is possible to secure definite confirmation at certain times of the day. On Sundays most of the Continental transmitters broadcast chimes, and where this is the case, the exact times have been given in a special table under this heading.

Although the majority of studios frequently give out their individual calls during the course of a programme, it often happens that the announcement is missed, or misunderstood. With the assistance of the tables given here with, and the estimation of wavelength at which the listener may arrive from his condenser readings, "mystery" transmissions should no longer puzzle the owner of a wireless receiver.

Mr. Ernest Newman, who broadcasts on music

A little experience, a little observation, added to common sense, will solve all his problems regarding the identification of foreign broadcasters.

LIST OF IDENTIFICATION SIGNALS

BELLS

(As interval signals)

Bratislava	Four notes : F, A, C, C.
Budapest	A phrase of nine notes, in thirds, repeated : G sharp, B, A, F sharp, G sharp; G sharp, B, A, F sharp, G sharp.
Cracow	Sledge bells.
Konigsberg	Two notes : A flat, D flat (perfect fourth).
Reval	Rapid ringing of bell as opening signal only.
Stockholm	Rapid ringing of bell.
Stuttgart	Three notes (oscillating valves) : C, D, G.
Toulouse (Radio)	One stroke of bell per second to indicate length of interval.
Radio Vitus	Two bells : F sharp, D sharp.
Zagreb	Bell struck twice.

Exclusive Article by J. Godchaux Abrahams

CHIMES

(Daily, except where otherwise stated)

Barcelona (EAJ1)	11.15 a.m. Chimes from the Cathedral.
Bergen	9.30 a.m. and 4 p.m. Chimes from the Cathedral.
Berlin	7.55 a.m. Chimes from the Potsdam Garrison Church. (Sun. only). 9 a.m. From the Cathedral.
Breslau	8.15 a.m. Chimes from Christ Church. (Sundays only.)
Cologne	8 a.m. Chimes from various churches. (Sundays only.) Chimes from studio as interval signal.
Copenhagen	7 p.m. and 11 p.m. Chimes and time signal from the Guildhall.
Cracow	11 a.m. and 7 p.m. Fanfare and time signal from St. Mary's Church in that city.
Danzig	10 a.m. Carillon from St. Katharine's Church.
Kattowitz	*See* Cracow.
Kosice	7 p.m. Chimes from the Church Tower.
Madrid (EAJ7)	12.15 p.m. and 2.15 p.m. Chimes from the Home Office Buildings. Sun., at 2.15 p.m. only.)
Moscow (RDW)	10 p.m. Chimes from the Tower of the Kremlin.
Munich	10 a.m. Chimes from the Guildhall. (Sun. only.)
Oslo	8.50 a.m. and 4.50 p.m. Chimes from the Heilands Church. (Sundays only.)
Posen	Opening chimes from the Guildhall.
Radio Paris	Westminster chimes from the studio before main transmission.
Warsaw	*See* Cracow.

GONGS

Berne Breslau Copenhagen	Three strokes on gong as opening and closing signal.
Cracow	Clock gong.
Frankfurt Hamburg Hanover Helsingfors	Three strokes on gong as opening signal.
Kattowitz Kiel Kovno	Hammer strokes on anvil.
Leningrad Münster	As opening signal only.
Reval	One stroke on gong.
Stockholm	To denote end of act when plays are broadcast.
Zurich	

HOOTERS

Copenhagen	Siren.
Munich	Siren (deep G).

LADY ANNOUNCERS

Barcelona (EAJ1) Berne	Occasionally.
Bratislava Budapest	When own transmission.
Cassel	When own transmission.
Cracow	Occasionally.
Hanover Kattowitz Milan Naples	When own transmission.
Nuremberg Posen Rome Warsaw Wilno	When own transmission.

METRONOMES

Berlin Berne Beziers	210 beats per minute.
Breslau Cracow Dresden	240 beats per minute.
Frankfurt Graz	192 beats per minute.
Kattowitz	120 beats per minute.
Konigsberg	240 beats per minute.
Konigswusterhausen Leipzig	210 beats per minute.
Lyons PTT	192 beats per minute.
Maroc (Radio)	108 beats per minute.
Munich Naples Posen	60 beats per minute.

Metronomes (*continued*)

Stamboul	120 beats per minute.
Vienna	264 beats per minute.
Vitus (Radio) Warsaw	
Zagreb	96 to 120 beats per minute as opening signal.

MORSE SIGNALS

Bremen	BMN (-... - - -.).
Dresden	DR (-.. .-.).
Graz	K (-.-).
Hamburg	HA (.... .-). Preliminary signal.
Hanover	HR (.... .-.).
Kiel	KL (-.- .-..).
Münster	MS (- - ...).
Vienna	SK (... -.-). At end of transmission.
Warsaw	W (.- -) as opening signal.

TUNING NOTES

Brussels	Similar to our home stations.
Cork Dublin	
Geneva	Three prolonged whistles as opening signal.
Milan Naples Rome	

TRUMPETS

Berne. Kattowitz. Posen. Warsaw. Wilno.

Output to the Loud speaker

NO modern set, unless it be for phone reception only, is complete without some kind of choke-condenser output circuit for the loud-speaker. Such circuits are, of course, a development of transformer coupling of the loud-speaker, but as a choke and condenser (a relatively cheap arrangement) is as efficient for most purposes as the rather more expensive transformer, the former has largely taken the place of the latter.

By-passing L.F. Impulses

It is necessary only to ensure that the condenser is large enough to by-pass all L.F. impulses, that the choke has sufficient inductance and is capable of carrying the D.C. current in the anode circuit of the last valve. Usual values are 2 microfarads and 50 henries respectively.

Suitable choke circuits are frequently published, and will also be found at the output end of most loud-speaker receivers. There are, in general, three distinct arrangements, one of which is the best for nearly all purposes as it enables one side of the loud-speaker to be at earth potential. This is an obvious advantage when high H.T. voltages are used and it is desired to carry the loud-speaker leads some considerable distance away from the set.

Simple Connections

The connections are simplicity itself. The 50-henry choke is connected between the anode of the last valve and the H.T. supply—that is, in the position normally occupied by the loud-speaker. The loud-speaker is connected on the one side to earth, and on the other—through the 2-microfarad condenser—to the anode of the valve. As no D.C. flows in the loud-speaker side of the circuit it is, of course, quite immaterial which way round the windings are connected.

BIM.

Get a New Zest for Radio!

By adding to the pleasure of others less fortunately placed than ourselves, we can all get better enjoyment from our own wireless activities, says the author of this article, who was for some years a prominent member of the B.B.C. Staff

I SHOULD like to suggest, if it can be done without any suspicion of superiority or preachiness, that if in our attitude towards broadcasting, we unduly emphasise our own likes and dislikes, we are going to miss a great deal of the pleasure to be derived from it.

Other Listeners

It may be a means of reviving our own interest in the programmes if we attempt to visualise the requirements of other listeners. After we have done this, it is not enough to adopt a policy of live and let live; we shall find a new zest in our pursuit of wireless if we can add to the pleasure of other listeners less fortunately circumstanced than ourselves. A good technical knowledge of wireless has its obligations as well as its privileges and pleasures.

Most of us have friends, relations, or acquaintances who are not in a position to acquire a satisfactory set. We might go out of our way occasionally to help them.

In Scotland people talk about "having a guid conceit o' ourselves," which means something very different from "swelled head." I should like the readers of this journal to have a good conceit of themselves in the Scottish sense of the phrase. They should realise that they are the very elect of the ether. Many of them possess considerable technical skill. They have frequently experienced the matchless thrill of listening to a foreign station on a set of their own construction.

Learning A Language

Have they looked around their circle of friends and acquaintances to see if there are any who would greatly appreciate some of these Continental transmissions? Do they not know any lad or girl learning a foreign language who would like to listen to Voxhaus or Radio-Paris?

There are many foreign residents in this country. Probably some of them are readers of this journal. Do they think of their poor compatriots who would be enraptured if they could hear a really good transmission from their own country sometimes? But any reader of this journal who can receive foreign stations could add greatly to the happiness of some strangers within our gates if he invited them to listen occasionally.

The same applies, of course, with even greater force to all the home talks. We may think many of them sad stuff, but we may discover others who would welcome the chance of hearing a talk in which they were particularly interested. We can soon find out the wireless tastes of our friends by a little judicious conversation. Some old people find headphones rather trying, and they would greatly appreciate a religious service on a good loud-speaker.

Greater Benefit

The same procedure could be adopted whenever there was a good vocalist or instrumentalist on the programme. You could easily find someone, outside your own family circle, who would benefit from such an item probably far more than you do.

If you are the happy possessor of a good portable set, the imagination positively staggers at the possibilities of usefulness in front of you. Of course, you would have to exercise a certain amount of circumspection in your wireless occasions, particularly if your altruism took the form of helping a young lady to learn French or German.

But there is no reason why a portable should not be more effective than a bow and arrow for Cupid's purpose. I am, however, thinking more particularly of doing wireless good turns to people who can give you nothing but gratitude in return.

Probably most readers are altruistic already, up to a point; but it may not be the practice of every reader to use his set for some definite, altruistic purpose, at least once a week.

If a considerable number of readers of WIRELESS MAGAZINE would act on this suggestion, it is quite certain that our own interest in the programmes would widen, and we should, perhaps, have a more sympathetic appreciation of the really wonderful efforts which the B.B.C. make to be all things to all listeners.

Other useful results might follow. It would be interesting exchanging experiences with kindred spirits. We should acquire a considerable amount of information about what the public really thinks of wireless.

Interchange of Ideas

It might be that, in time, we could prevail upon the Editor to provide a corner of his precious space for the interchange of ideas. At the present time we have strong feelings about many of the aspects of broadcasting, but we have little authoritative data, and that not of a comprehensive kind.

The B.B.C. sadly require outside, reliable, candid, but kindly criticism with as much constructive suggestion as possible. It is high time that an authoritative attempt was made to check the B.B.C.'s estimate of their own importance and of their performance.

In that excellent compendium, *The B.B.C. Handbook*, the Director-General says: "One trusts that the reader will be able to say of this retrospect of five years' broadcasting activity that it has steered a reasonable middle course between philosophic neutrality and over-emotiveness without falling into self-satisfaction."

Dull Thud for the B.B.C.

Well, if that is the kind of thing they expect listeners to say, and if that is the kind of language they expect listeners to use, then the B.B.C. ought to have a dull thud at the earliest moment.

It may be that, ultimately, a League of Wireless Helpers might be formed, which would make its voice heard in Parliament and elsewhere. That, however, is a hypothetical consideration for the future. The need at the moment is for all wireless enthusiasts to extend the usefulness of wireless by every means in their power.

WALTER C. SMITH.

Half Hours with the Professor

A CHAT ABOUT HIGH-FREQUENCY CHOKES

"I SAY, Professor," exclaimed Amp one day, bursting into the Professor's laboratory.

"You would," interrupted Megohm with a grunt, looking up from his desk, where he was busy with some calculations.

An Extraordinary Thing

"Would what?" queried the boy in astonishment. "Oh, ah," he continued with a grin, "funny joke! But as I was saying, I came across a most extraordinary thing a day or two ago."

Megohm put down his slide-rule with a resigned air and settled himself down to listen to the Amp's tale of woe. The boy, meanwhile, was prattling away, blissfully unconscious of the fact that he had interrupted the Professor in some important calculations and proceeded to give full and harrowing details of a receiver which he had been trying unsuccessfully to operate according to his expectations.

"Couldn't get the blinking thing to pull properly, you know, Professor," said Amp. "Seemed to be lacking in beans, although I couldn't find just what was wrong until I yanked out the H.F. choke quite by accident and tried another one. Perfectly 'xtrornary."

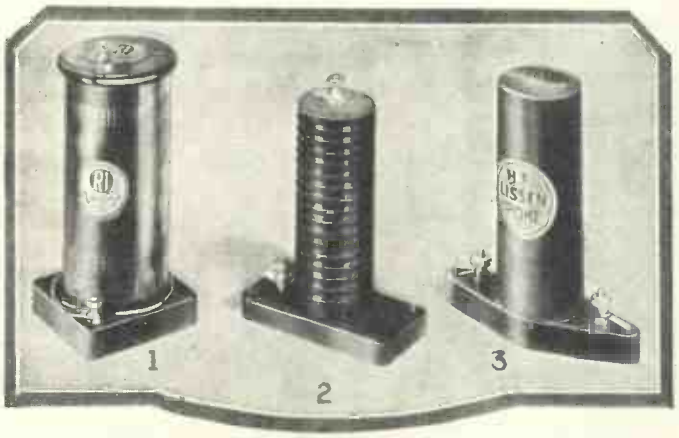
Difference in Results?

The Professor nodded. "As far as I can gather," he remarked gravely, "the changing of the H.F. choke made some difference to the results."

"Made a difference!" cried the other. "Lumme, I should say it did—but," he asked with one of his characteristic changes of mood, "why should that be, Professor? I mean, what is there in an H.F. choke, anyhow, to make all that difference?"

"Just the difference between a well-designed component and a poor one, I should imagine," smiled Megohm. "After all, you use an H.F. choke for a particular purpose and the results you get depend upon whether it fulfils that purpose adequately or not."

"Yes," agreed the boy slowly, "that is really obvious, isn't it? What I don't quite understand is what constitutes a good and a bad choke?"



WELL-KNOWN AND EFFICIENT HIGH-FREQUENCY CHOKES
1.—R.I. & Varley. 2.—Lewcos. 3.—Lissen.

"Quite a lot of people do not know the answer to that question," was the smiling reply. "After all, the subject is rather an interesting one and it is just as well that you should understand what is involved."

Megohm fished in his pocket for his pipe and slowly proceeded to fill it while he thought of the best way in which to present the subject to the boy. "You know something of the properties of a resonant circuit, don't you?" he resumed at length.

"Yes, I think so, Professor."

"Well, when we tune a coil with a condenser we gradually reduce the inductive effect of the coil until we reach a point where the circuit is at resonance, when the inductive effect and the capacity effect cancel each other out. If we go beyond this point, then the condenser exercises the predominating effect and the arrangement acts as a capacity. Is that clear?" Amp nodded.

Inductance and Capacity

"Good," continued the other. "In exactly the same way, if we have a coil with a fixed condenser across it, then as we vary the frequency of the current which we pass through it so the circuit will behave first of all as an inductance and will then pass through the resonant point until it behaves as a capacity. Below the resonant frequency, the arrangement is inductive and above it the circuit acts like a capacity. Do you see that?"

"Somewhat," admitted Amp, with a slight frown wrinkling his brow.

"Well, if you have a general idea it will suffice. You will see why I mentioned this point first in a few moments. Now," he proceeded, "what do we use an H.F. choke for?"

"Choking," remarked Amp facetiously.

Most Efficient Condition

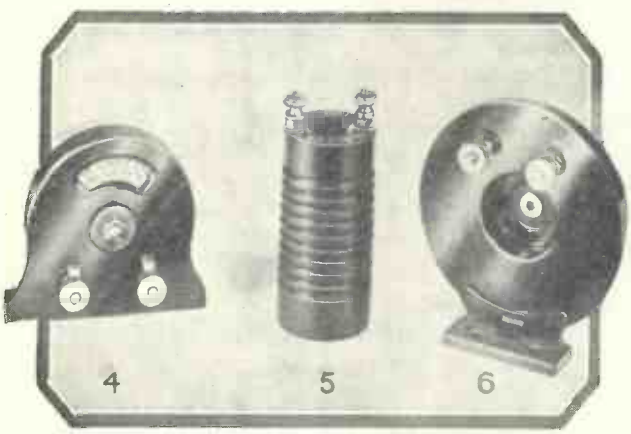
"Exactly," agreed Megohm, rather to his surprise. "That is precisely what we do wish to do. We wish to prevent any high-frequency currents from flowing through the circuit at all and clearly the most efficient condition for doing this is that of resonance, when the inductance and capacity of the circuit actually resonate with the applied frequency;

Half Hours With the Professor (Continued)

in which case the H.F. choke will present a very large impedance to any high-frequency currents."

"But," objected Amp, "I don't quite see what capacity you are talking about. We were discussing the H.F. choke, which as I see it is an inductance."

"So it is, my boy, but any inductance has a certain self-capacity and owing to the large number of turns of



MORE GOOD HIGH-FREQUENCY CHOKES
4.—Burndept. 5.—Peto-Scott. 6.—Igranic.

wire on a choke, the self-capacity is often quite large."

"Then do you mean to say that the inductance of the choke and the self-capacity can form a tuned circuit?"

Formation of An Actual Tuned Circuit

"Most decidedly so. The self-capacity is augmented to some extent by stray capacities due to the arrangement of the circuit, but the total capacity effect certainly resonates with the inductance of the choke and gives us an actual tuned circuit, which, as I have just said, will give the maximum choking effect at the resonance point."

"But," broke in the Amp again, "I always thought that resonance was to be avoided in an H.F. choke."

"Not necessarily," was the answer. "The exact requirements, however, depend rather upon the use to which the choke is to be put and we will come back to that point again later. The fact remains that the choke presents its greatest impedance at the frequency which corresponds to resonance between the inductance and the capacity.

What the Upper Choking Limit Is

"Below this frequency (that is for wavelengths greater than the natural wavelength), the impedance of the choke falls off rapidly and a point is soon obtained where it ceases to become an effective carrier to high-frequency currents at all. This is what is known as the upper choking limit."

"I know," broke in the other, "I've seen test reports in the WIRELESS MAGAZINE giving the upper choking limit of various makes."

"Yes," agreed Megohm, "that is quite true, they find out where that limit occurs in the course of their tests. Now," he resumed, "below the natural wavelength the choke acts practically as a pure capacity of a very small value, nearly equivalent to the self-capacity of the choke itself. This will act as quite a good barrier to high-frequency currents and so will maintain a high choking effect."

Why a Small Condenser Cannot be Used

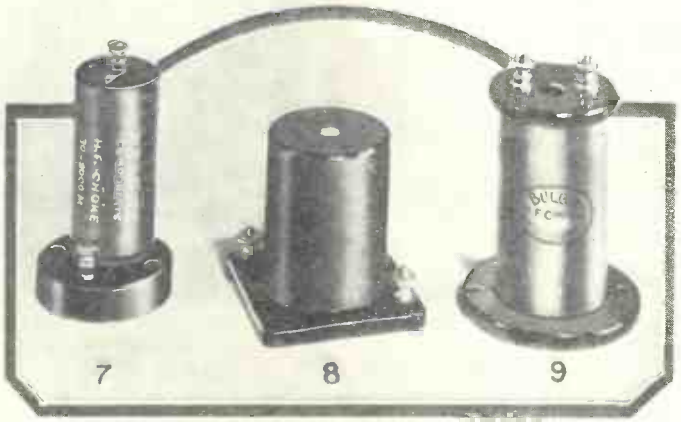
"Well, then," asked Amp in a puzzled manner, "why can we not use a small capacity and have done with it?"

"Because in the majority of cases where a high-frequency choke is used, we desire to have a path for direct currents as well; as for example, in the anode circuit of a valve where we must supply the high-tension voltage to the anode. A small condenser would not permit steady current to flow and therefore we cannot use such an arrangement."

"Oh, I see," said the boy, "of course, I ought to have thought of that. It seems," he continued after a short pause, "that the problem is not quite as simple as I thought it was."

Choking Limit Above Received Wavelength

"It is simple from some aspects, but not by any means so from others," smiled the Professor, poking down the ash in his pipe with his pencil. "The point you want to remember is that for the choke to be efficient, its self-capacity must be very low, in fact, the lower the better. Secondly, we want the upper choking limit (which usually occurs just above the resonant peak), to be well above the maximum wavelength we wish to receive.



ANOTHER BATCH OF HIGH-FREQUENCY CHOKES
7.—Wearite. 8.—Dubilier. 9.—Bulgin.

"To do this and still to keep a small capacity means that we must have a large inductance and it is here that the skill of the designer comes in in producing an inductance of reasonably efficient form having a very low self-capacity."

"Then an ordinary coil won't do. Is that right?"

"It will act to some extent, but it will not be as efficient as a high-frequency choke coil specifically

A Chat About High-frequency Chokes

designed to have high inductance and very low self-capacity. Now this choke," he went on, picking up one that stood on a bench near-by, "has an inductance of 150,000 micro-henries with a self-capacity of less than 2 micro-microfarads. That is an efficient choke.

A Better Choke

"You could get exactly the same effect as regards the maximum choking wavelength by having a coil of 15,000 microhenries inductance with a self-capacity of 20 micro-micro-farads. Both chokes would cease to be effective about the same point, but the first choke would be very much better than the second over the actual working range owing to its very much smaller self-capacity."

Amp thought this over for some time to himself and finally said: "Well, Professor, my ideas about H.F. chokes seem to have been all wrong. I certainly never realised that there was such a lot in such a simple bit of work. As a matter of fact," he went on, "I always thought a high-frequency choke was built up in a sort of series of sections. I mean they nearly always seem to wind these chokes in sections and I thought perhaps the first section choked over the first bit of the scale, so to speak, and then the next section over the next bit and so on."

A Very Old Fallacy

Megohm laughed. "That, as a matter of fact, is a very old fallacy," he said. "Some such action as that might take place if all the different sections of the choke were separated from each other. However, they are all coupled together and form part of a whole, so that they cannot be considered as acting independently like that. No—sectionalising is only done in order to reduce the self-capacity and it is quite effective in this respect. If the whole choke were wound in a solid lump, its self-capacity would be considerably higher than the value obtained by splitting it up into a large number of sections."

"H'm," said Amp shortly, "I do seem to have been a long way off the track. Then does a choke always act in the way you have just mentioned?"

"It does where you really want it to act as a choke," was the reply. "Occasionally chokes are used as coupling devices in the anode circuit of a valve and here the whole of the circuit must be considered rather from a different angle. For satisfactory working here, the choke must either be very efficient or it must be deliberately designed to have an inductive reactance. In either case, resonance anywhere near the working range is to be avoided, but you need not trouble yourself very much with these special cases. For all ordinary purposes, the action is as we have just seen."

"Well," said Amp, "that is very interesting indeed. I feel that I know quite a lot about H.F. chokes now."

Megohm rose silently from his seat with a twinkle in his eye. Walking over to the far end of the Lab., he picked up a skeleton H.F. choke wound on a sectionalised former in the conventional fashion.

"Very good, Mr. Man," he said, handing the sample choke to the boy. "Perhaps you will tell me whether you consider that would be a good choke or not."

Amp looked at the choke, suspecting a leg-pull on the Professor's part. However, the Professor seemed perfectly grave apart from a certain twinkling of the eyes which caused him serious misgiving. On inspection, he saw that the choke had a number of sections—ten he found there were by counting—and they were all wound full with a fairly fine gauge of wire.

"Well," he volunteered at length, "it looks all right Professor. There seems to be quite a lot of wire on it, anyhow."

Peaks in Working Range

"There certainly is that," agreed Megohm smilingly. "As a matter of fact it has quite a high inductance and quite a low self-capacity, but it is no good because it has peaks in the working range."

"What do you mean, 'peaks'?" asked Amp.

"I mean that there are certain points at which it ceases to act as a proper choke. In fact, it will pass current at these points and may even set into oscillation any circuits associated with it. Obviously such a choke is not satisfactory."

"Good lor'," said the boy, "why on earth should it do that?"

Acceptor Circuit

"Well," said Megohm, "that is quite a long story which I do not propose to go into. The various sections link up with the capacity effect between them and form a sort of acceptor circuit. I really raised the point just to show you that H.F.-choke design was not quite as simple as it looked."

"So it seems," agreed the boy.

A RADIO RIOT

(Or the Wireless Fan's Nightmare)

Last night in the small hours, I state with regret,
A Radio Riot broke out in my set—
The aerial caused it, it's fully agreed,
And everything followed the aerial lead;
She entered the set with the stealth of a cheetah,
And the volts all came up in a body to meter
The screws were all "screwed" and as soft as a flannel,
And the brackets proceeded to hold up the panel;
The valve holders held up the valves till they broke,
And regarded the jest as a practical choke;
The wander-plugs wandered around and around,
But the earth wire was frightened and ran to the ground;
And during the riot, I'm sorry to state,
A low-frequency valve got away with the plate,
And as they looked down on this terrible error,
The coils all recoiled in a spasm of terror;
The switch like a witch with a twitch of despair
Shot up and then down in the murderous air;
When the tension was high in my radio set
The grid crept away and leaked tears of regret.
But someone enjoyed it, I'm sorry to mention—
The speaker, who asked for a longer extension.
And that is the end of my harrowing ditty,
I've unluckily run out of puns—
(Morse the pity!).

C. P. P.

Earl of Birkenhead

Rt. Hon. Stanley Baldwin

Rt. Hon. J. H. Thomas

OUTSIDE BROADCASTS :: Problems and :: Adventures

WHEN I was discussing this subject recently at the B.B.C. an official told me that the outside work was still somewhat in the nature of an adventure to him and he personally never started out for a fresh location without feeling in the highest spirits.

Good Telling

So much has now been reduced to routine, however, that the surprise element has almost been crowded out of existence. But even to-day things happen to make good telling. The arrangements for events such as St. Leger are all made and tested the day before, of course. Last year when the engineers were about to leave the ground someone noticed rather threatening clouds in the sky, so it was decided to sling a waterproof sheet over the apparatus.

The following morning was bright, brilliant even, and no one thought of rain, far less of the puddle formed on the sheet overhead. When the first engineer entered the "tent" he found the roof too low for him and put up his hand to push it up, thereupon the water, at least a couple of gallons of it, ran off on to the head of the second man!

Last Derby Day also makes a good story. The selected position was in the Press stand, but some of the disadvantages had not been taken into account. Before very long, people started going in and out of this box in one continuous stream, as, of course, they have to in order to get off the various results and stories.

The floor was concrete, and the noise of dozens of pairs of boots stamping up and down the steps of the stand just flooded the microphone to the exclusion of all else. They tried all the dodges their cunning could suggest, but the amount of improvement was small. When the last race had been run one of the engineers looked at his chief wonderingly and asked what on earth would happen on the morrow.

"Goodness knows," was the reply, "There's only one thing which would do any real good, and that is a big carpet to cover the floor of the Press box and the top steps. But I know we can't get that, so I suppose we shall have to carry on and hope for the best."

A Great Honour!

The engineer nodded and went his way. The next morning the chief was welcomed by a beautiful carpet spread out just as he had indicated. Apparently the engineer had spoken very nicely to an official of the course, who had dug up a long-forgotten carpet, which not only made a good commentary possible but caused all the Press men to wonder why *they* were being thus honoured.

Although this particular difficulty was smoothed out at the eleventh hour, yet it is clear that it was responsible for a considerable amount of worry. It is not surprising to find the officials of the "O.B." department saying of their engineers that they are "wonderful fellows, who seem to be never beaten."

A Commentator's Troubles

As a matter of fact I can give a splendid example of their work. Mr. Abrahams was broadcasting the results of an Athletic Meeting at Cambridge from the usual little hut. After about ten minutes a terrific crowd suddenly surged in and remained in that part, gradually blocking his view. When it showed no signs of improving he turned to one of the engineers and demonstrated the trouble.

The latter saw at once that there was only one thing to do—to move. He therefore looked round for a better spot, and decided upon the roof of the small lorry which had brought the gear. When the next event finished the whole of the apparatus was removed from the hut and fixed up with Mr. Abrahams lying down on the top of the van. And this was accomplished in the short interval between two events, about 20 minutes.

Mr. Abrahams once experienced a most trying afternoon. He was on the van again, and the spectators in front of him were all provided with

programmes. The wind was blowing towards him and every now and then a programme was borne straight at him; some covered the microphone, others his eyes and others still his mouth. Yet I wonder how many listeners could put a date to that "adventure"?

Fitted Van

Most "O.B.'s" to-day are carried out from the "studio-on-wheels," which is a van fitted up with all the gear necessary. This has simplified matters considerably. The procedure is now as follows: An official goes down to the location with a Post Office representative. He decides where he will put his van, and the Post Office run a line from their nearest point. Then the van is driven to the spot, the land-line connected up—and that's all. There is no setting up of apparatus, or arranging of batteries and yards of wiring, since this is allready and waiting in the van.

The eye-witness can see all over the ground from a seat inside, but should a higher viewpoint be required a special point has been fixed up on the roof, and the change can be made as quickly or quicker than the commentator can climb up.

The B.B.C. can now claim that their "O.B." department has covered the whole of this country with its organisation and reduced many of these broadcasts to routine. It was not without some difficulty that this state of things was brought about.

Liverpool Cathedral can be switched on with the ease of a studio concert, yet this beautiful building at one time provided possibly the greatest problem of all. Since the organ pipes were separated on opposite sides of the chancel two microphones had to be used, one for the lower notes, and the other for the higher ones.

Suspension from the Roof

The only way of fixing them was suspension from the roof, quite a job in itself. Once a "guessed" position had been fixed, testing was commenced with the organ. And here the real work started. Apart from the general acoustic difficulty, there was the problem of balancing the two sets of pipes.

The engineers cannot recall the exact number of times they had to alter the positions of the microphones, but it was around fifty, and every time someone had to climb a hundred and fifty steps to reach a height of 135 feet. A single alteration occupied about twenty minutes. If there were, then, fifty such, the total time spent was sixteen hours forty minutes.

Actually they were two days on this job. In the end they had to use three microphones, one 95 feet up and the other two 45 feet.

The broadcasting of the service at the Cenotaph on Armistice Day provides another example of the work of the O.B. Department. Listeners will recall that it was two or three years before the Home Office would agree to the B.B.C.'s proposal and that when the first attempt was made some criticism was aroused because the microphone was slung from a wire running overhead across Whitehall.

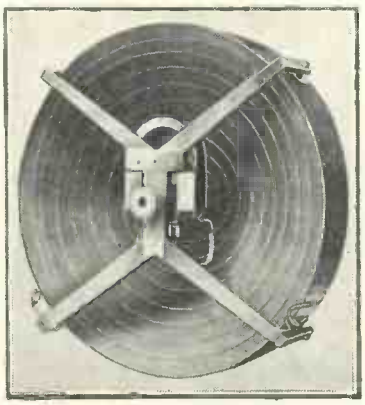
This has now been overcome in a most ingenious fashion; in fact, so cleverly are they hidden I doubt if any of the public realise that there are two microphones listening all the time. Connection is made underground with a line to Savoy Hill. This "land-line" was, of course, specially laid and the point is covered by a plate which can be seen on a close examination of the road.

Second "Mike"

The second microphone for "effects" is usually placed in a tree near the Post Office and the wire carefully coloured to escape detection. So careful are the B.B.C. to keep these details secret that the fixing and testing are done at dead of night when no one is about to witness it.

FRANK ROGERS.

Can You Recognise This?



No? Think again. Yes, you are right. It is the driving unit and reinforced diaphragm of a Celestion loud-speaker

A Question of Efficiency

IN no other branch of engineering, electrical or otherwise, are technical men apparently so regardless of efficiency as in wireless practice. Motor engineers, in particular, are very keen on efficiency, as expressed in terms of the energy put into and obtained from a car. Radio engineers, on the other hand, are rather naturally apt to discourse more on volume and purity than on actual efficiency.

Poor Efficiency

As a matter of fact, the efficiency of many wireless components is distinctly poor, loud-speakers being particular offenders in this respect. Even the best horn-type loud-speaker can rarely boast of a better efficiency factor than 2 per cent., and many cone speakers are even less efficient. The major part of the power is wasted in setting up eddy currents and in hysteresis losses, while mechanical losses, caused by unnecessary movement of the diaphragm or cone, are considerable.

It must not, of course, be assumed from this that by careful manufacture present-type loud-speakers could be improved by about 98 per cent!

Unless some epoch-making invention comes to light, and methods of loud-speaker reproduction are completely revolutionised, present efficiency factors are not likely to be improved. It is almost inevitable that in the search for "naturalness"—which means something more than purity—volume, the practical symbol of loud-speaker efficiency, should be reduced.

Question of Volume

A badly constructed moving-coil loud-speaker is capable of being very much inferior to a cone instrument from the point of view of reproduced volume, while even the best M.C. instruments are apt to be a little "soft" in comparison with moving diaphragm loud-speakers. Any power losses, however, are more than made up for by vastly improved reproduction; and with a good-quality instrument there is so little difference in volume from a given input between a moving-coil and a moving-diaphragm instrument that the ear cannot detect it.

And that is what matters!

QUEUE.

In this article is described the construction and operation of a simple three-valve receiver that can be used for radio reception or for gramophone work—the records being reproduced through an electromagnetic pick-up, amplifier, and loud-speaker. Home entertainment can therefore be obtained at any time of the day—or night, if desired!

The Festival Three

LOUD-SPEAKER RECEPTION OF THE LOCAL STATION AND DAVENTRY AT LEAST

INCORPORATES SIMPLE ALL-WAVE TUNER WITH REACTION

ALL PARTS READILY OBTAINABLE

COMPRISES DETECTOR AND TWO LOW-FREQUENCY STAGES

SIMPLE TO BUILD: EVERY CONNECTING WIRE NUMBERED

The wave-change switch is part of the vernier reaction dial on the left

DANCE MUSIC AT ANY TIME FROM GRAMOPHONE RECORDS

PROVIDED WITH EFFECTIVE VOLUME CONTROL

USES R.C. AND DUAL-IMPEDANCE COUPLING

SPECIAL "MOTOR-BOATING" STOPPER INCORPORATED

DESIGNED, BUILT AND TESTED BY THE "W.M." TECHNICAL STAFF

ENTERTAINMENT BY RADIO OR GRAMOPHONE AT ANY TIME

AT this time of the year, entertainment is the order of the day—and, for that matter, of a large part of the night. Moreover, no home entertainment scheme is complete nowadays without a good radio set.

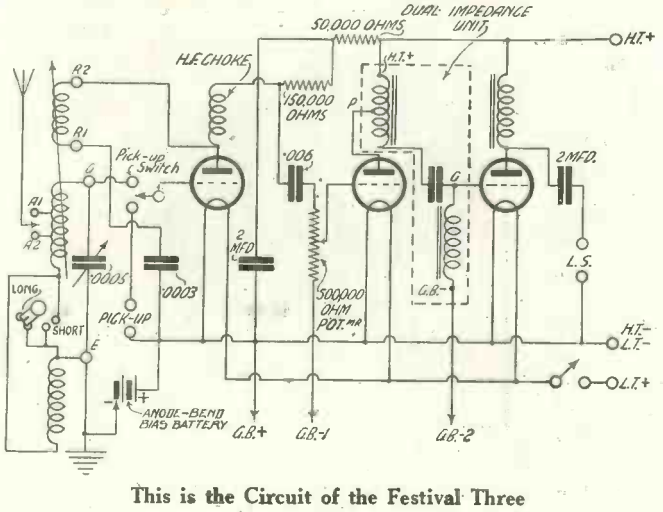
Limited Programmes

In addition, a point to be taken into consideration is that broadcast programmes are not available at quite *all* hours of the day and night, and the programmes that can be picked up may not be of the desired kind.

For these reasons the WIRELESS MAGAZINE Technical Staff has designed the Festival Three, a set that will get the local station and Daventry almost anywhere in the country, and with which it is possible to reproduce gramophone records electrically. The Festival Three is a real source of entertainment and enjoyment, therefore, and the ideal set for use in many homes.

As regards the purely radio use of the Festival Three, it can be said that the set is a one-knob affair, capable of receiving on the lower and upper broadcast bands without coil changing. No great range is claimed for this receiver (it has no high-frequency amplifier as has the Standard-coil Three described on page 548), but on an average aerial it should be possible to pick up a number of foreign transmissions on the loud-speaker.

For use as a gramophone amplifier an electromagnetic pick-up is connected to two terminals provided and the electrical vibrations set up by the cuts in the record grooves are magnified and reproduced from the loud-speaker. The volume obtained in this way is controlled by a knob on the front panel.



This is the Circuit of the Festival Three

Circuit Combination

Actually, the circuit combination comprises an anode-bend detector (for obtaining the best quality of reproduction) and two low-frequency amplifiers. The arrangement will be clear from the diagram on the left. From this it will be seen that the tuner is wound in two parts, one being short-circuited when it is desired to carry out reception on the lower broadcast band. This tuner is controlled by a

.0005-microfarad variable condenser.

The tuning coil is led to the grid of the detector valve through a switch which inserts the electromagnetic pick-up in series when desired. For radio reception the biasing battery is adjusted so that 1½ or 3 volts negative are applied to the grid of the detector valve; this ensures the most efficient bottom-bend rectification.

"Detector" As Amplifier

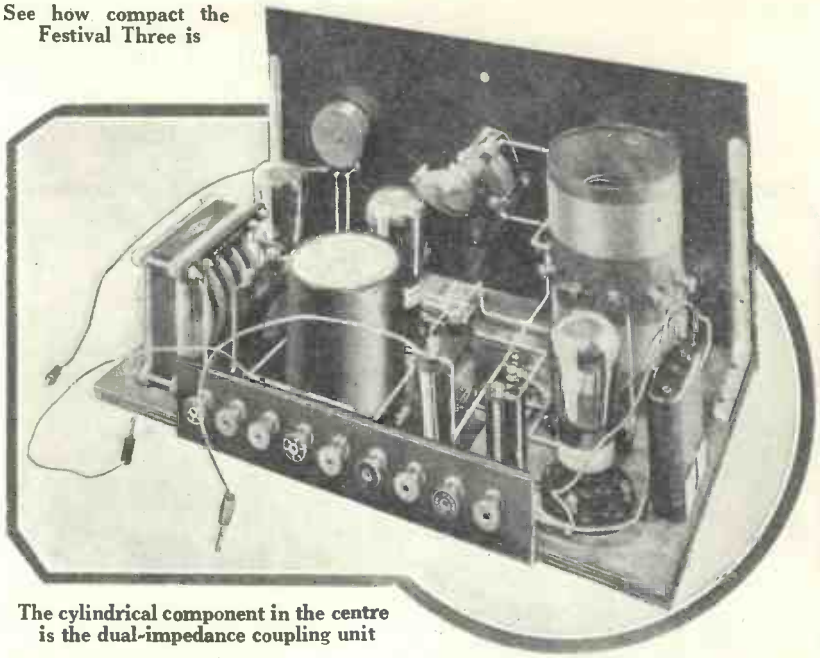
This bias is not needed for gramophone work, however, and usually the "detector" valve will be used without any voltage on the grid so that it actually amplifies.

For radio work reaction is applied to the detector. This is obtained by blocking the passage of high-frequency currents in the anode circuit away from the battery leads and passing them through a coil coupled to the aerial tuner. Parallel feed is obtained by bringing one end of the reaction coil to low-tension negative through a .0003-microfarad fixed coil, the coil itself being adjustable to vary the amount of feedback obtained.

Low-frequency Circuit

From this point onwards the circuit is the same for radio or gramophone work. The detector is coupled to the first low-frequency valve by the resistance-capacity method. This coupling is also provided with a "motor-boat" stopper so that the set can be used successfully when run direct from the electric-light mains.

See how compact the Festival Three is



The cylindrical component in the centre is the dual-impedance coupling unit

The stopper consists of a 50,000-ohm resistance with a 2-microfarad shunt to low-tension negative.

The actual coupling values used in the original set are a 150,000-ohm anode resistance and a .006-microfarad fixed condenser, used in conjunction with a 500,000-ohm grid potentiometer acting as a variable leak to control the volume obtained from the set.

A dual-impedance unit is used for coupling the first low-frequency valve to the output valve. This consists of a 140-henry choke in the anode circuit, a .03-microfarad coupling condenser and a 150-henry choke in the grid circuit of the output valve. The anode is centre-tapped to the anode impedance so that virtually a 1 to 2 auto-transformer is obtained.

Low D.C. Resistance

An advantage of this type of coupling is that the direct-current resistance of the anode impedance is comparatively low and consequently the greatest possible voltage is applied to the valve, which is thus able to handle greater input without overloading.

It will be seen that the anode and grid impedances are virtually in parallel, so that the resulting effective impedance in the anode circuit is 40 or 50 henries, a value high enough to ensure that plenty of bass will be reproduced.

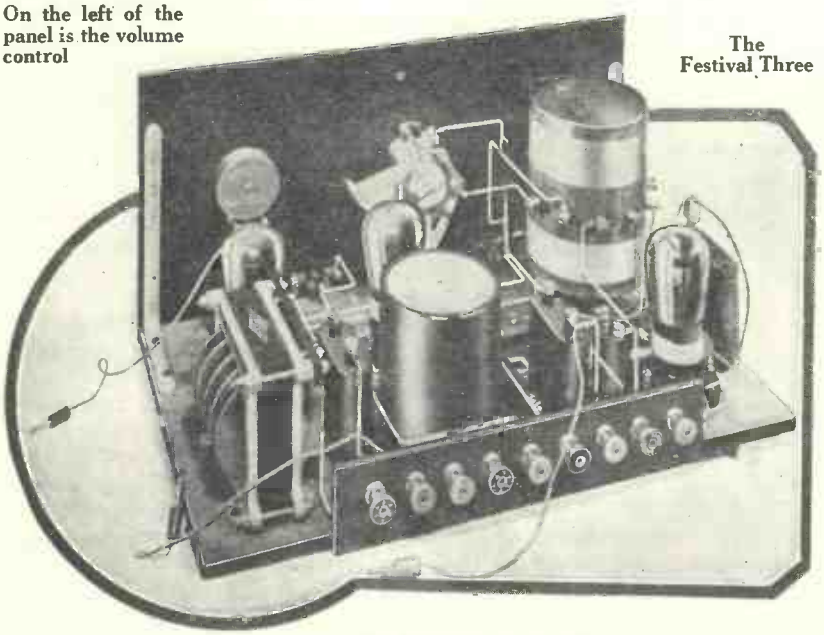
Choke-capacity Output

In order to protect the loud-speaker windings from the heavy current that is certain to pass in the anode circuit of the last valve a choke-capacity output is provided. This takes the form of a 30-henry choke (at 50 milliamperes) and a 2-microfarad fixed condenser. It is especially desirable that a good choke be used, otherwise the bass will be lost.

Let us now turn to the set itself. A glance at the photograph of the front of the Festival Three will reveal that there are three dials arranged across the centre of the panel; these are respectively a combined reaction

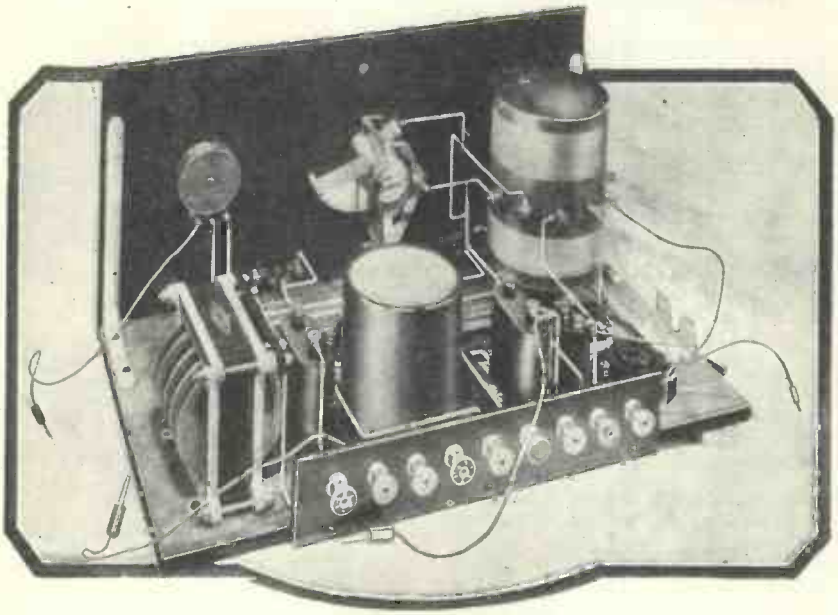
On the left of the panel is the volume control

The Festival Three



The dual-range tuner with reaction is seen at the right of the panel, close to the anode-bend biasing battery

The Festival Three (*Continued*)



Another view of the Festival Three showing positions of components

READ THE GRAMO-RADIO SECTION OF THIS ISSUE

control and wave-change switch, the main tuning condenser and the volume control. At the bottom of the panel are the jack-switch for controlling the pick-up (left) and the push-pull on-off switch for connecting the low-tension supply. There are, therefore, no complications about the control of the receiver.

Components Used

Some remarks regarding the actual components used will not be out of place here. The dual-range tuner is the new R.I. and Varley model, which is one-hole fixed to the panel. This is provided with two aerial terminals so that the degree of selectivity can be varied as desired.

A small vernier dial is provided for controlling the position of the reaction coil and this can be coupled either way round, so it does not matter how the actual terminals are connected.

Underneath this vernier dial is a small projection actuating the switch for short-circuiting the long-wave portion of the tuner for reception on the lower broadcast band.

All the parts comprising the dual-impedance coupling are contained in a cylindrical case on a square base provided with four terminals. There is thus no difficulty about connecting up the set.

A number of the parts used in the construction of the Festival Three can be substituted without seriously impairing the performance, but as far as possible constructors are recommended to keep to the list of components below.

COMPONENTS REQUIRED FOR THE FESTIVAL THREE

1—Ebonite panel, 16 in. by 8 in. (Becol, Parfait, or Keystone).
1—Dual-range tuner (R.I. and Varley).
1—.0005-microfarad variable condenser with slow-motion control (Jackson Bros., or Gecophone).
1—Dial indicator (Bulgin or Belling-Lee).
1—Jack switch (Lotus No. 7).
1—On-off push-pull switch (Lotus, Lissen, or Bulgin).
1—Anti-microphonic valve holder (W.B., Lotus, or Trix).
2—Ordinary valve holders (W.B.)
1—.0003-microfarad fixed condenser (Graham-Farish, Dubilier, or T.C.C.).
1—.006-microfarad fixed condenser (Graham-Farish, Dubilier, or T.C.C.).
1—150,000-ohm resistance with holder (Graham-Farish, Trix, or Ediswan).
1—50,000-ohm resistance with holder (Graham-Farish, Trix, or Ediswan).
1—High-frequency choke (Keystone, Igranic, or Burndept).
1—Dual-impedance coupling unit (Formo).
2—2-microfarad fixed condensers (Ferranti, Dubilier, or T.C.C.).
1—500,000-ohm volume-control potentiometer (Frost Radio).
1—Low-frequency choke (Parmeko, R.I. and Varley, or Ferranti).
1—Grid battery clip (Bulgin).
1—Terminal strip, 10 in. by 2 in. (Becol, Parfait, or Keystone).
9—Terminals, marked :—Aerial, Earth, Pick-up (2), L.T.+, L.T.−, H.T.+, L.S.+, L.S.− (Eelex or Belling-Lee).
1—Pair panel brackets (Raymond).
1—Cabinet with 9 in. baseboard (Caxton).

Full-size Blueprint

The WIRELESS MAGAZINE Technical Staff knows that a certain section of "experts" shudders at the mention of a full-size blueprint for building a set, but it nevertheless has no hesitation in stating that the use of a blueprint will definitely save even the "expert" time, if only on account of its utility as a panel-drilling template, whilst as a boon to the novice its value is inestimable.

Moreover, a blueprint costs very little and one of the Festival Three can be obtained for 6d. if the coupon on page iii of the cover is used by January 31. Address your enquiry to Blueprint Dept., WIRELESS MAGAZINE, 58/61 Fetter Lane, E.C.4. Ask for No. W.M.118.

A glance at the photographs and blueprint (or the reduced reproduction on page 570) will show clearly how all the parts are arranged and there is no need to explain the construction here in detail. All the panel components are one-hole fixed and the baseboard parts are laid out in a perfectly straightforward way.

Wiring Up

When everything has been firmly fixed into position, wiring up can be started and here the blueprint will be found a great time-saver even to those who are expert at reading theoretical circuit diagrams. Every wire is numbered and in all there are forty connections to be made.

If each lead is connected in its proper order the wiring will be assembled in the most convenient way from the baseboard upwards.

Entertainment by Radio or Gramophone

As each connection is made cross through the number on the blueprint.

The next point to consider is the choice of suitable valves. The detector should have an impedance about one-third of the resistance in the first anode circuit, that is, in the neighbourhood of 60,000 to 80,000; in fact any normal R.C. type of valve will be suitable.

Different Anode Resistance

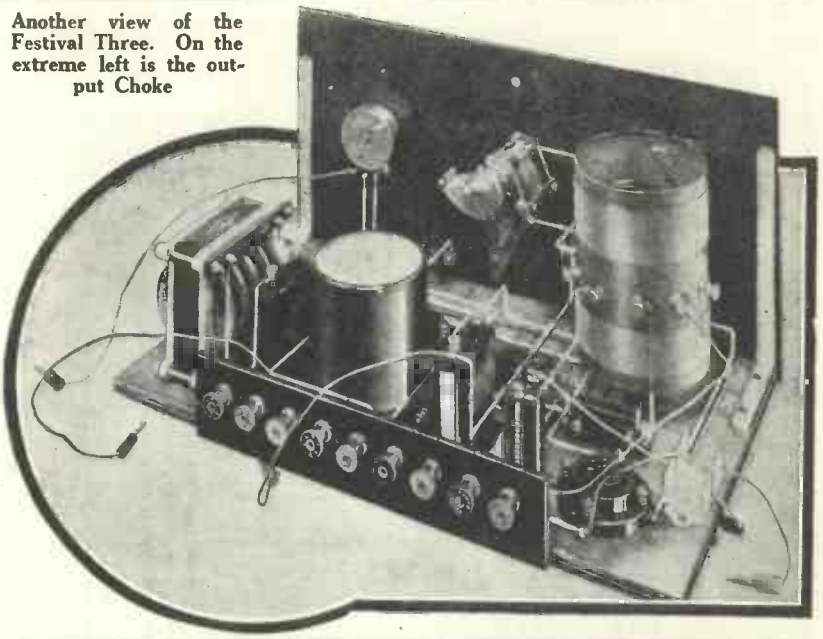
If the constructor has already on hand a particular valve he wishes to use he should substitute a different value of anode resistance, if necessary, remembering that this should be approximately three times the resistance of the valve.

In the second holder—that is, as the first low-frequency amplifier—a valve with an impedance as high as 20,000 ohms can be employed. Such a valve usually has a rather limited grid swing, and it is probable that 10,000 ohms is the best all-round value with modern valves. In our tests we have found as low an impedance valve as the Mazda LF607 quite satisfactory.

Final Output Valve

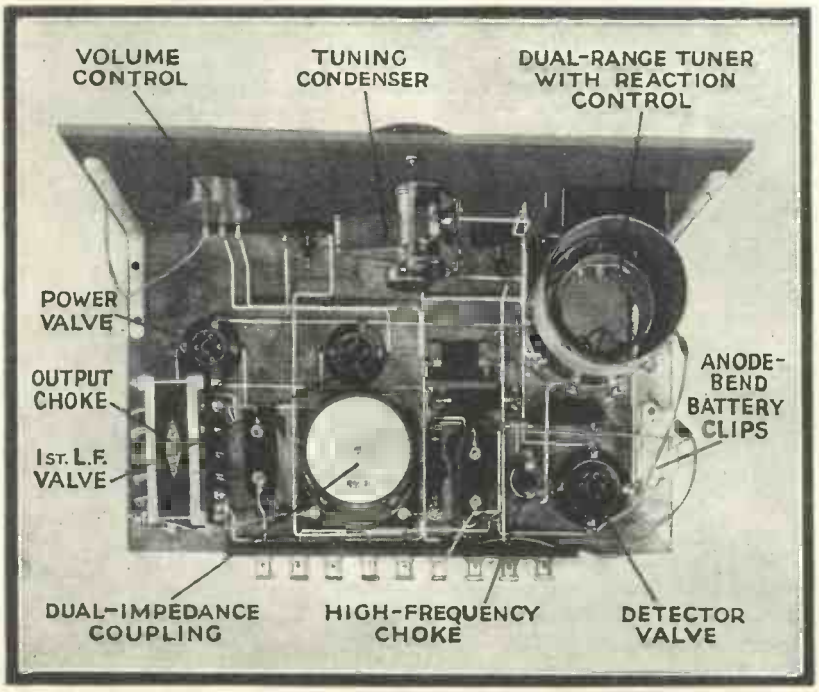
The last or output valve should normally have an impedance of about 2,500 to 4,000 ohms, depending upon the type of loud-speaker used. If a moving-coil instrument with its own output transformer is used, by the way, the choke-capacity output incorporated in the receiver itself can be omitted and the loud-speaker connected direct in the anode circuit in the usual way.

To test the receiver connect up the necessary batteries, applying anything up to 200 volts to H.T.+. Normally 1½ volts negative bias should be applied to the grid of the detector valve by means of the 4½ volts battery mounted on the base-board. To G.B.—1 apply about 3 to 4½ volts and to G.B.—2 the value recommended by the valve manufacturers, which will probably be in the neighbourhood of 18 volts.



Another view of the Festival Three. On the extreme left is the output Choke

BUILD THIS SET AND TELL US WHAT YOU THINK OF IT!



This plan view of the Festival Three clearly shows the layout of all the parts

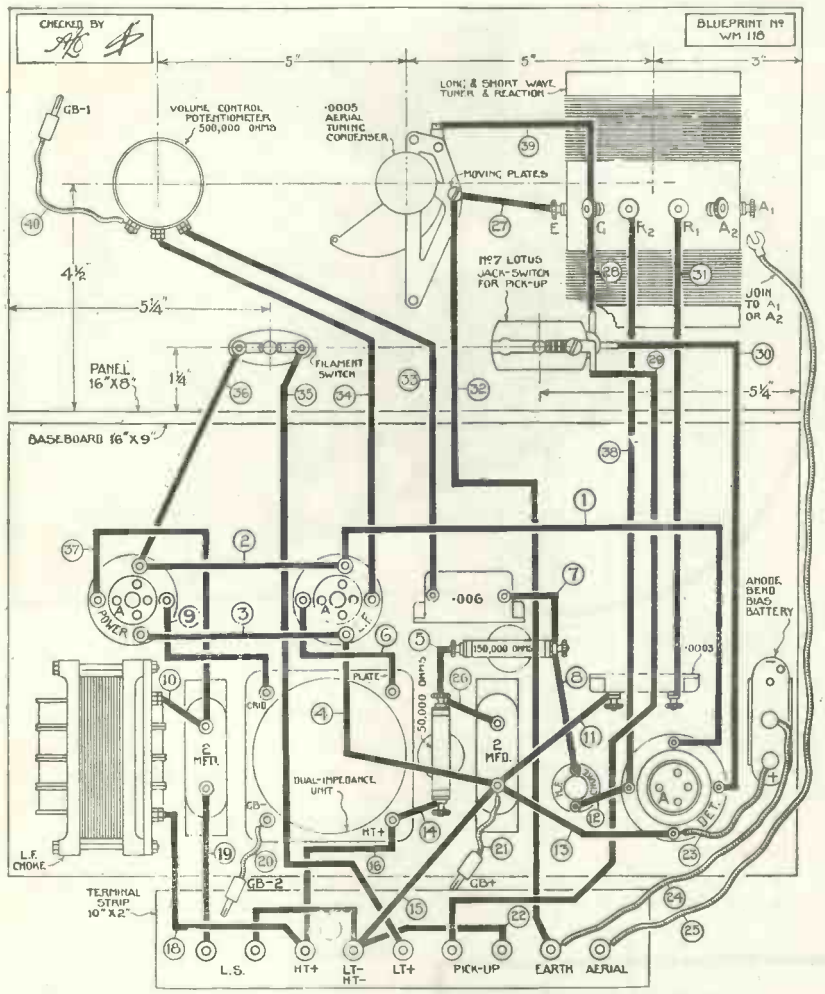
Operating the Receiver

There is no difficulty about the operation of the Festival Three. Adjust the wave-change switch (underneath the reaction dial on the left of the panel) to "Long" or "Short" as desired and pull out the knobs of both switches at the bottom of the panel; that on the left switches the pick-up terminals out of circuit and that on the right completes the low-tension circuit.

Reaction Control

Turn the knob of the volume control on the right of the panel, as far as possible to the left, that is, in an anti-clockwise direction. This ensures the greatest possible signal strength. Next turn the reaction control either side of the zero mark (that is, over either the red scale or the black scale) until the slight rustling or hissing sound is heard which indicates that the set is on the verge of oscillation and therefore in its most sensitive condition.

The Festival Three (Continued)



LAYOUT AND WIRING DIAGRAM OF THE FESTIVAL THREE.
This layout and wiring diagram can be obtained for half-price, that is 6d. post free, if the coupon on page iii of the cover is used by January 31. Each wire is numbered in order of assembly. Ask for Blueprint No. W.M. 118

Now turn the knob of the main tuning condenser, in the centre of the panel until a transmission is picked up. As soon as a station is heard try altering the bias applied to the detector valve to get the greatest signal strength. Try also altering the aerial tapping for the best results.

Results on Short Test

Should the local station be too strong, as it will be with a normal size of aerial and an adequate high-tension supply, turn the knob of the volume control a little to the right and so reduce the volume to the desired amount.

To use the set for gramophone work, connect a pick-up to the terminals provided and push in the knob of the left-hand switch. There is no need to touch the tuning or reaction controls, but the volume control should be adjusted for the most pleasing reproduction with different types of records.

Tested on a small indoor aerial in Kensington with high-tension supply obtained from an Atlas D.C. mains unit, both Daventrys were received at good loud-speaker strength while London could be cut-out without difficulty. Several foreign stations were heard, but just only faintly.

There is no doubt that with a normal outdoor aerial a number of Continental stations can be picked up at good loud-speaker strength, especially if 6-volt valves are used. For the test mentioned the valves used were two-volters—an Osram DEH210, a Mazda GP210 and a Mullard PM252 being employed.

Enough has been said to indicate the possibilities of the Festival Three and it only remains for those readers to whom it appeals to order the parts and begin the construction. When it has been finished, everybody who builds it is invited to let us know their opinion of it.

Every letter published about a set in these pages is something more than a mere boost for the WIRELESS MAGAZINE—it is a definite help to those who are thinking of building a new set.

It is not our policy to make unsubstantiated claims for our receivers so help your fellow-readers by letting them know what you think of your WIRELESS MAGAZINE set.

A Further Test of the Inceptor 3

(Continued from page 553)

running the risk of confirming it in practice!

In every instance, unless otherwise stated or queried, the transmitters have been definitely identified. You will also notice that I have placed a cross against stations which did not give a readable signal on the loud-speaker.

Bad Atmospherics

As it happens, it was my ill-luck that on four of the evenings in question atmospheric conditions were peculiarly unfavourable; as a matter of fact, one of the nights was that of the recent gale, which brought down both my long and short aerials, and a substitute had to be rigged up hurriedly the next morning.

I do not pretend that the annexed logs constitute a record, but they are very satisfactory, and I feel safe in stating that there can be but few three-valve receivers built at the extremely low cost of the Inceptor 3 which will compare in results with those obtained.

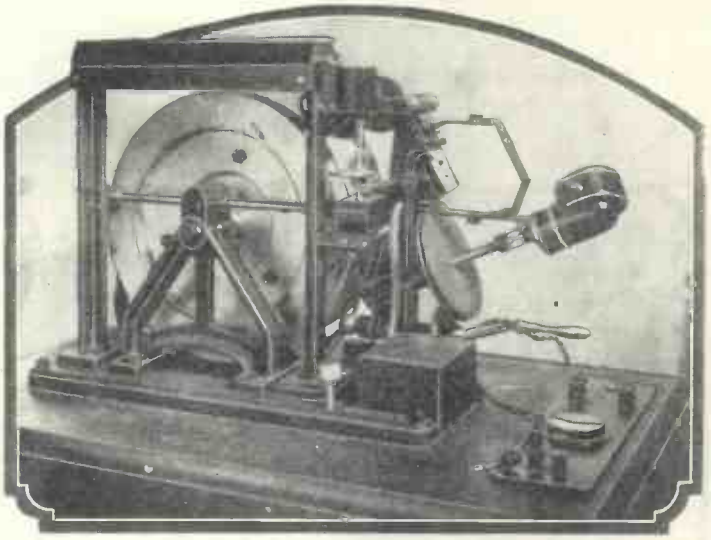
To the man who can only afford a moderate-priced wireless set and who desires to listen in comfort to Continental broadcasts, the Inceptor 3 will achieve much more than he would expect of it.

[In the November issue W. James described his Touchstone, and in the December issue details of the coils were given]

A WIRE THAT TALKS!

By A Special Correspondent

GREAT progress has been made recently by a German scientist, Dr. Curt Stille, with the "talking wire" apparatus over which the daily Press waxed so enthusiastic a short while ago; and when Dr. Stille was in London recently (writes a "W.M." Special Correspondent) I had the opportunity of obtaining a full description of how the talking wire apparatus works, and of testing it for myself.



Side view of the "talking wire" machine.

Famous People see Demonstration

A demonstration was also given to a few important spectators, including Sir John Snell (chairman of the Electricity Commissioners), Colonel Sir Wilfrid Ashley, the Minister of Transport, and Mrs. Ashley, and Mr. Selfridge. For the purpose of the demonstration, a B.B.C.-type microphone was used, at which Mr. Thorpe Bates sang, and Mr. Darewski's band played jazz selections, and so on.

The microphone output was taken through a two-stage L.F. amplifier to the recording side of the talking-wire apparatus, and a programme of about thirty minutes' duration was recorded.

Reproduced Through 3-Valve Power Amplifier

Then the spool was rewound so that the starting end of the wire was on the outside of the bobbin, and a three-valve power amplifier was connected to the output side of the machine which was switched on to an ordinary cone-type loud-speaker.

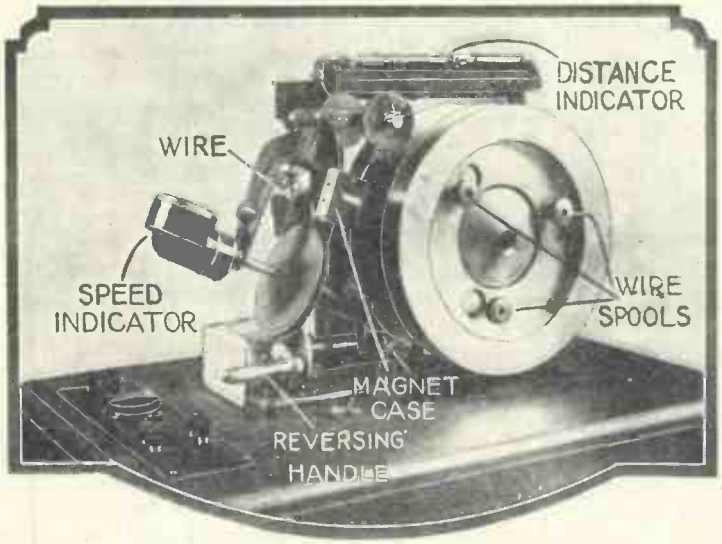
The whole of the programme was reproduced immediately at full loud-speaker strength and with most satisfactory purity. The sole background was a slight hiss when the wire was started up, apart from the normal very faint amplifier hiss, and there was an entire absence of crackling noises and surface scratch, such as is almost invariably connected with wax recordings of the dictaphone type.

Principle Known Years Ago

It says much for the initial accuracy of recording, too, that the boost-up given by a three-stage low-frequency amplifier did not show defects. It must be mentioned, also, that the reproduction was spontaneous, and was not "perfected" as might have been a commercial gramophone record made from a carefully prepared master record.

The mechanism of the talking-wire apparatus is very simple, and it is opportune to mention here that the principle upon which it works is not entirely new. Poulsen, of singing-arc fame, was experimenting along similar lines some thirty years ago, but it has been left to Dr. Stille to perfect the idea and make it a commercial success.

The mechanism used for the demonstration was that shown by the accompanying photographs, while I have also had the opportunity of testing a smaller machine, capable of recording about twenty minutes' speech and which it is intended to use in offices.



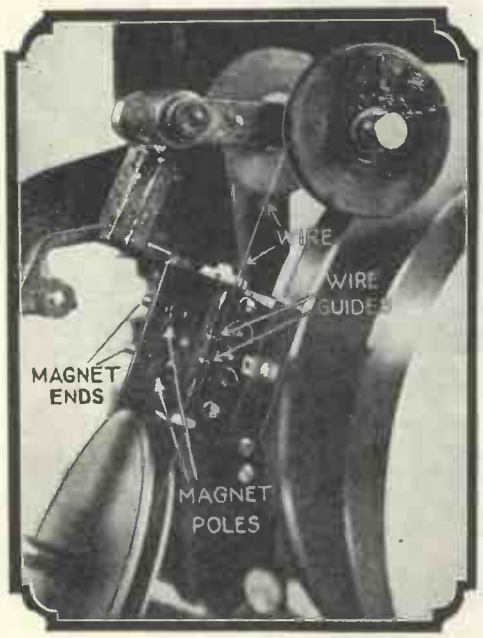
Another view of the new recording machine.

How the Machine is Arranged

The wire is thin springy steel of about No. 30 gauge not insulated in any way. It is stored on one of the aluminium spools of the machine, passes round various pulleys as shown and is finally connected to the second drum. The drums are belt-driven by a small electric motor contained in the base of the

A Wire That Talks! (Continued)

machine, and there is a belt-shifting mechanism for changing over the drive from one drum to the other. The speed of the wire is about one metre per second for speech, and is increased to about two metres per second when both speech and music is to be recorded. The higher speed,



Above is a detail view of the new recording machine, showing how the wire is run between magnets

though not at all critical, is better when a very wide frequency scale is to be impressed on the wire.

A speed indicator is carried on the shaft of the large inclined pulley on the extreme left of the machine, while a cam-operated sliding scale at the top shows the length of wire run, and allows of the spools being set back to any desired point.

How Speech is Recorded

The recording process is, of course, entirely a magnetic one, and there is no mechanical change as there is, for instance, when a gramophone record is made. It is dependent on the fact that if a steel wire passes between magnet points carrying the field fluctuations of a speech current, these fluctuations will be impressed magnetically on the wire and can be stored. Reproduction is effected by an exact reverse process.

Actually there are two sets of magnets, one being used for "transmitting" and the other for "recording." They are arranged in the housing so that both north-pole magnets are on one side and both south-poles on the other, one facing pair of opposed magnets constituting a set. The magnets are bar magnets, about 1¼ in. in length and ⅛ in. diameter. They carry spools of fine wire roughly ⅝ in. diameter and ¾ in. long, facing spools being connected in series. Guides are arranged near the magnet points so that the wire does not scrape against them.

No Amplification

It is quite possible to work the apparatus without any amplification whatsoever. The transmitting set of magnet windings is connected in circuit with a 45-volt dry cell and a microphone, and the resulting magnetic field is sufficient to disturb the molecular arrangement of the steel wire. The output from the pick-up bobbins can be taken direct to headphones or to an L.F. amplifier if it is desired to operate a loud-speaker.

Any irregularities in the motor speed cause a peculiar wavering of frequency, as happens when a record with deep sound grooves is played on a gramophone with a weak-spring motor. This is not an important objection, however, and I noticed only one or two isolated instances of this tendency to "lose" a note.

The reproduction is very natural, but it seemed to me that whereas the upper end of the audible scale was very faithfully reproduced, the low notes were apt to suffer.

The wire can be cut and rejoined by a sweating process in a few seconds, and I proved for myself that new speech impressed on a wire already carrying a recording almost completely wipes out the previous sound impressions.

Short-wave enthusiasts will be interested to know that the call-sign of the famous Dutch short-wave station is now PCJ instead of PCJJ.

A Safe Killing

IT was easy enough to say, answer the fellow in his own coin; but, somehow, you just couldn't do it. The words stuck in your mouth. There he sat, comfortably ensconced in a fat arm-chair on the other side of the fireplace, and talked,—just talked. The trouble was that he talked about Tariff Reform, and his views were exactly the opposite of those which his listener fervently held.

Suppose one threw something. . . . No; it wasn't worth it. The neighbours would surely get to hear and he would be the laughing-stock the whole district.

He leaned forward, as though to say something, but sunk back again as the utter impossibility of trying to stem that flow of eloquence dawned upon him. A wry smile twisted the corners of his mouth for a moment.

There was something hypnotic about the fellow, the way he waggled his fingers at you, for instance. They fascinated. And then his smile—that oh, so reasonable smile. A surely-you-can-see-my-point smile; confound him!

The other man felt he could stand it no longer. Something in his brain seemed to go snap, and a murderous urge swelled within him.

Stealthily he reached for the poker in the grate beside him. His fingers encountered it, and with a sudden jerk he threw it hard and straight at the smiling figure seated before him.

He paused, aghast at his deed.

There was a horrid tinkle.

Which only goes to show to what lengths a combination of controversial broadcasts and television will drive an otherwise peaceable individual.

J. A. D.

A Selection of Letters from Readers Who Guide Others by Saying

What They Think of Our Sets!

THE TOUCHSTONE

HERE is a copy of a letter about the Touchstone (WIRELESS MAGAZINE, *November*, 1928) *from a Woking reader to the Ready Radio Supply Co.:*

In reply to yours of 2nd inst., I am pleased to say that the Touchstone set was duly delivered on the 1st. inst. Your representative soon coupled it up, balanced it, made one or two points clear to me, and handed it over in perfect working order.

It *is* a wonderful set and I am quite pleased with it in every way. I may mention that I picked up sixteen foreign stations yesterday at full loud-speaker strength, quite apart from the English stations.

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INCEPTOR 3

AMATEURS all over the country are sending us enthusiastic letters about the Inceptor 3 (WIRELESS MAGAZINE, *October*, 1928), *which comprised a screened-grid valve, detector, and pentode. Here is a letter from a Regent's Park reader:*

I would like to thank you very much for that remarkable set, the Inceptor 3; the results I have obtained from it are truly astonishing when compared with the ordinary three-valve receiver. I dismantled my old set and used what parts I could, so it looks a little different from the original set as you describe it.

I had a little trouble with it when first trying it out due to bad coils, but on purchasing some good coils, incidentally a double-tapped coil for the aerial, everything is just as it should be—selectivity, volume, and purity, it's all there.

With my old three-valve receiver I was tied down to three or four stations, owing to poor aerial and earth, but the Inceptor 3 apparently thrives on such conditions as these, for I've had a wonderful bag over the week-end it's been really exciting.

I gained a slight increase in volume by lifting the aerial coil holder up off the copper-foil covered baseboard.

ANOTHER reader at Caldy thinks the Inceptor 3 *is "twice as good as any other three-valver":*

I have made up your Inceptor 3, using the same circuit, but with a slightly different panel layout—using two separate condensers.

The results are wonderful. I have received the following stations on a loud-speaker: Dublin, London 2LO, Vienna, 5GB, Milan, Budapest, Langenberg, Frankfurt, Toulouse, Manchester, Liverpool, Belfast, Glasgow, Madrid, Barcelona, Cologne, Stuttgart, Hamburg, together with five unidentified transmissions.

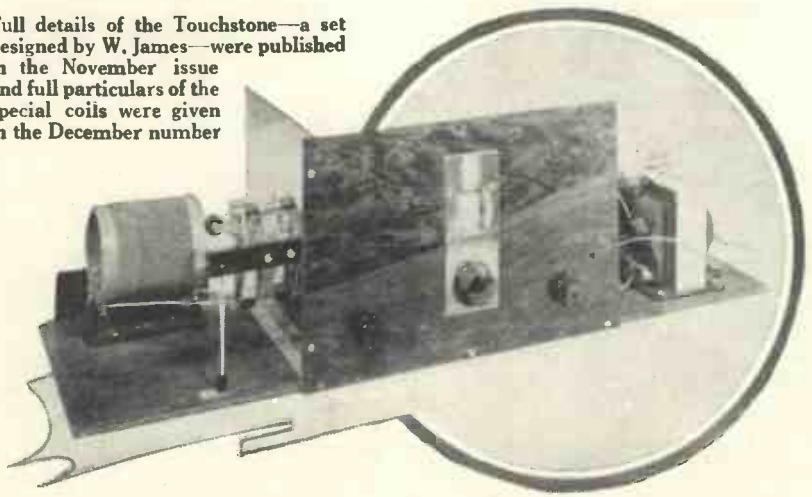
On the high waves I have received: 5XX, Radio-Paris, Motala, Hilversum, Koenigswusterhausen. On attaching a pair of phones to the set on the high waves Kalundborg was audible on its new wavelength. On the lower waves, I logged Kattowitz, Stockholm, Munich, and three unidentified transmissions.

I have no hesitation in saying this set is quite as good as most four-valvers I have seen and twice as good as any other three-valver.

CONGRATULATIONS have also been sent by a Hove reader in the following letter:

I have just completed constructing the Inceptor 3 as per your October issue. You will be interested to hear that apart from tuning in fourteen stations on Sunday evening, at perfect loud-speaker strength, I tuned in and enjoyed from 9.30 p.m. to 11 p.m. last night, W.G.Y., Schenectady, at good loud-speaker strength, apart from slight fading.

This I consider excellent and I congratulate you on giving details of such a set.



Full details of the Touchstone—a set designed by W. James—were published in the November issue and full particulars of the special coils were given in the December number

The Best Possible Three-valver made by a Keighley reader

BEST POSSIBLE THREE-VALVER

OLD readers of the WIRELESS MAGAZINE *will remember that this set was described in our issue of December*, 1925. *The following letter from a Keighley reader has just been received:*

About two and a half years ago I built a four-valve wireless receiver, following the design of the Best Possible Three-valver and the instructions given in the WIRELESS MAGAZINE of December, 1925. Later, I added a fifth valve to the set, and obtained fine results. The set is still working wonderfully, such that everybody who hears it says that it is the best set they have ever heard.

I am very proud of the set, and so have taken a photograph of it. I wonder if the enclosed print will be of any use to you for publication in your magazine?

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LINEN-DIAPHRAGM LOUD-SPEAKER

HUNDREDS of enthusiasts have made up the linen-diaphragm loud-speaker (WIRELESS MAGAZINE, *September*, 1928) *and most of them are as pleased with it as the Erdington reader who sent this letter:*

With reference to your recent article on the making of a new linen-diaphragm loud-speaker, I thought I would like to write and tell you that I have made the loud-speaker in accordance with the instructions you gave, and find it most satisfactory.

The high and low notes are reproduced without sign of resonance and there is excellent volume from a small input.

What They Think of Our Sets ! (Continued)

1927 FIVE

ALTHOUGH details of it were published so long ago, the 1927 *Five* (WIRELESS MAGAZINE, *October*, 1926) *is still popular amongst many overseas amateurs, as this letter from a South African reader testifies :*

On Monday, October 22, 1928, Johannesburg's new high-power station was opened. Their wavelength is about 450 metres. I picked them up on my set, which is the 1927 Five, and they came in at good loud-speaker strength, the only H.T. battery was a 60-volt one that has been in use about six weeks.

P.S.—Johannesburg is about 850 miles air line from here.

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FIVE-GUINEA THREE

SIMPLE sets using two-pin plug-in coils are always popular and the Five-guinea Three (WIRELESS MAGAZINE, *November*, 1927) *is no exception. Here is a letter from a Cardiff reader :*

I have read with great interest a letter which was published in the October WIRELESS MAGAZINE from an Antwerp amateur, and I am very pleased to say that I can endorse all he says with reference to the purity and clarity of tone given by this receiver.

I built the Five-guinea Three in January of this year, and I am more than pleased with the results obtained. Friends of mine who have heard my set are so "taken up" with it that they have built one for themselves, and are just as pleased as I am with mine.

My wife obtains a great deal of pleasure from it as well as myself, as it is so simple to manipulate. She is able to listen in to the morning service direct from London every day on the loud-speaker, as Cardiff is not working at this time. I have no high wavelength coils, so it cannot be coming through 5XX.

I am unable to say what this splendid little set will do on the high waveband owing to not having the coils, but I can put approximately fourteen stations on the loud-speaker when Cardiff is not working, and that at very good strength. I can get Langenberg loud enough on the loud-speaker to fill a good-size room, and that with Cardiff on, and also a number of other Germans, but, of course, I am able to get the best results from the set when Cardiff is not on.

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DOMINION SHORT-WAVE THREE

AT this time of the year renewed interest is being taken in short-wave receivers and, therefore, the following from a Liverpool reader about the Dominion Short-wave Three (WIRELESS MAGAZINE, *November*, 1927) *should be read :*

Having been a reader of the WIRELESS MAGAZINE for some considerable time I was pleased to read your Dover reader's report on the Dominion Short-wave Three. I made it up myself two months ago with all components specified, and have had good results, but could not get it to oscillate under 30 metres.

I have tried everything with the exception of a larger reaction coil. With a No. 2 in the aerial, No. 4 grid, and No. 9 reaction, I could just manage PCJJ, and this morning before purchasing my WIRELESS MAGAZINE I made the suggestion of a larger reaction, but was advised such a procedure would not rectify the fault.

Thanks to your publishing Dover reader's report maybe I shall get over the snag which has badly puzzled me. I added the *Amateur Wireless* "Add-on H.F. Unit" and was surprised with the extra selectivity obtained. The long-wave stations are excellent, also the broadcast band; in fact, last Tuesday night I tuned in Manchester, Stuttgart, Radio-Toulouse, and Hamburg all on loud-speaker without the *least interference from one or the other.*

I passed the remark that if I could get the set to oscillate under 30 metres what an ideal receiver it would be.

I hope you will publish this letter if only to catch Dover reader's eye. Perhaps he has been as anxious to see reports on the Dominion as I have.

I intend trying a screened-grid H.F. unit shortly—maybe Dover reader has done so.

I will try the 12-turn reaction coil and, if successful, will let you know results obtained.

THE CRUSADER

THIS simple two-valver (WIRELESS MAGAZINE, *May*, 1928) *proved one of the most popular sets described this year. One Glasgow reader has even received 3LO, Australia, on it :*

To let you know the results I have had with the Crusader two-valver, published in May. Every component in my set is of the cheap sort, and I have built the set inside a soap box. The reaction condenser I am using is .00025-microfarad instead of .0001-microfarad. I have also a .0005-microfarad fixed condenser in series with the .0005-microfarad variable tuning condenser.

I have logged 2XAF, 2XAD, KDKA, 3LO, 2NM, PCJJ, and many other stations too numerous to mention. I have made three short-wave sets since May, and in my opinion the Crusader is the winner. My aerial is 100 ft. with a .0001-microfarad fixed condenser in series with it.

A SCHOOLBOY reader at Letchworth also has something to say about this "jolly good two-valver" :

Although I am sure you have far more letters than you want, yet after last night's effort with the Crusader (WIRELESS MAGAZINE, May, 1928) I feel that I must let you know how pleased I am with this really remarkable little set.

I made it at school a few weeks ago, and last night, although atmospherics were very bad, I managed to fetch in about twenty stations, many of them on the loud-speaker.

Stuttgart, Toulouse (389.1 metres), Cologne, Leipzig, and others all came in at loud-speaker strength. Besides this I get Radio-Paris and Hilversum most days at good phone strength, although when 5XX is working this station interferes, as I have not got a No. 120 centre-tapped coil yet.

Recommending the Crusader to anybody who wants a jolly good two-valver and wishing your paper every success.

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CONNOISSEUR'S SIX

SELECTIVITY and purity of reproduction from the Connoisseur's Six (WIRELESS MAGAZINE, *August*, 1928) *have pleased a Rossendale reader, who writes about it as follows :*

Having constructed the Connoisseur's Six—and, although I cannot say that I fully understand the working of it yet, it is truly what its name implies, whether used on radio or for the reproduction of gramophone records.

I have built many super sets, but none approaches this one for selectivity *with* purity of reproduction. I am using two LS5A's in the last stage with about 220 volts on the plates, and the result on a moving-coil loud-speaker is really wonderful.

Another good feature is the ease with which one can change over from radio to gramophone—so easy, in fact, that my little girl of ten can do it quite easily. I am more than satisfied.

My First Studio Adventure

By David Lystaner

The studio cat. Black enough to be lucky!

ON the last Saturday of last month there befell me the greatest wireless adventure I have had as yet. It was a real adventure in the strictest sense of the word, a breathless adventure—to wit, my first experience of broadcasting a talk from one of our broadcasting studios to all you listeners.

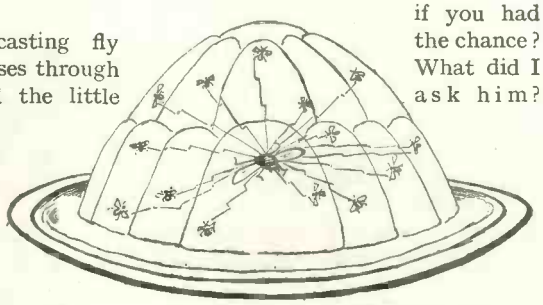
Have you ever wondered what it is like at the other end of what we call the ether? Like the naughty schoolboy, you are so used to being at your end of the stick that you never give a thought to the pleasing personality at the other end.

From Both Ends

Let me, then, try to explain this wireless from both ends, as it were. To do so, I shall use an analogy of which I am very fond, namely, that of a large jelly with flies in it—live flies—a big, fat fly (the broadcaster) in the middle of the jelly and lots of little flies (listeners) elsewhere in the jelly.

The big, fat, broadcasting fly kicks a leg. A shiver passes through the whole jelly and all the little listening flies feel the shiver. You see the idea? Very well, then.

On the occasion of my first broadcast I, an ordinary little listening fly, living in a remote corner of the etheric jelly, betook myself to the very centre of that same jelly, and there, for a little while, swelled out into the big, fat, broadcasting fly, and sent shivers through the etheric jelly to all the listeners who listened to me.



The broadcasting fly in the middle of the jelly

Now you have the idea of wireless from both ends. What does it feel like at the other end—the broadcasting end? Great people who have broadcast to us have told us of their adventures in broadcasting. I want to tell you of the broadcasting adventure of a very humble and unsophisticated person—one as humble and unsophisticated as yourself, perchance.

Was I very nervous as the time of my broadcast talk drew near and I entered the studio building? Yes, I was nervous, all right; but, luckily for me, as I entered the artists' waiting-room two things claimed my attention.

The first was a burning desire for a huge bucketful of cold, clear water from a limpid mountain stream with which to ease my parched throat. The second was a black cat—at least, it had sufficient black on it to suggest good luck to me. The rest of it was white underneath.

The announcer? Oh, yes, I have been face to face with a live announcer! He actually shook hands with me and asked me how I was, and I—er—was—er—how I was. So pleasant and so reassuring was he in his manner that I asked him a question. The question? Ah! What question would you ask an announcer if you had the chance? What did I ask him?

Well, my question was a very simple one. It was:

"Is this your cat?"

And he replied to me:

"No, it is a stray one; poor thing."

Now I want to ask you: Did you know that a broadcast studio was a place of refuge for stray cats and, further, did you know that announcers receive those stray cats with kindness, and even prevent musical directors from kicking them out?

We walked down to the studio, the four of us—the announcer, the cat, myself, and the boy. Near the studio door the order of our procession changed and the cat got in first. Frankly, I was afraid of that cat. The possibility of its mewing during my talk appalled me.

Mewing of a Cat

I have never heard the mewing of a cat broadcast, and I do not know what people would have thought of me if that cat had mewed while I was speaking. At my request, the announcer, with great reluctance and in a most experienced manner, put the cat out and shut the studio door.

You as a listener may perhaps object to your broadcast talkers reading their talks. If you are ever called upon to broadcast a talk, your objection to reading that talk will vanish. In the studio, your manuscript, let me tell you, is the lifebuoy which saves you from going under. Without that manuscript there would be no talk—at least, there would not have been from me.

Reading to the "Mike"

I began to read to the microphone. My voice sounded as if it did not belong to me. The mechanism of my speech appeared to have passed to someone else's control and my thoughts raced ahead of the spoken word.

Cold, prickly oscillations ran up and down my spinal system as I began to wonder if I had actually completed the third sentence back from the one I was speaking, and six back from the one I was reading. An awful sensation, truly. I broke the spell by pausing and looking at the studio clock. Oh, for that

My First Studio Adventure (*Continued*)

barrelful of water from the mountain stream !

Do you know, I think they overdo the sound-damping idea in our studios. Even when I had regained something of my quiet confidence at the end of my talk, the absolute deadness of the studio made me feel as if the announcer was speaking to me out of oblivion.

The boy sat very still as I read my manuscript into that sphinxian microphone. On the way home I asked the boy to give me his impressions of our studio adventure. He told me that the studio seemed to him like an Eastern palace, the fuggy curtains of which were heavy with the fumes of much incense burnt before the god of the microphone.

Five-year-old Talk

He thought that you might still wring many a good five-year-old talk out of those curtains. The red light over the studio door perturbed the boy. He said it made you realise you could not get out of the studio and that made you want to get out.

I asked the boy what he thought of the announcer. He said the announcer shimmered about the studio like Jeeves in P. G. Wodehouse's books.

"When the announcer went out during your talk," said the boy, "he actually slammed the door, and there was I sitting so quiet that I hardly dare swallow for fear of making a noise."

A truly great adventure for all of us.

Ships Use Wireless for Medical Aid

TO-DAY every large passenger ship of any importance carries one or more surgeons, and some of the large liners have hospitals of their own, complete with operating theatres and everything necessary for emergencies.

Ships Without Doctors

Although the list of vessels carrying a medical officer may seem a large one, there are many ships that do not carry a doctor. What of those small tramps which are found on every ocean, or those cargo vessels which sometimes take weeks on a voyage, and are out of sight of land for most of the time?

Very often the captain or mate of such a vessel is also the acting doctor, and with his sometimes small knowledge of medicine is able to attend to the minor ills of his crew.

But, there are certain radio stations from which free medical advice may be obtained from any ship of any nationality.

In Denmark there are two stations giving free medical service and in Sweden one. Blaavand (CXB) and Copenhagen (OXA) are the Danish stations, while Goteborg (SAB) is the Swedish station. In the case of a ship calling up Copenhagen and asking for advice the message would be at once passed on to the Seaman's Hospital in that city, from which the doctors would pass the necessary advice direct to the ship.

Public Health Service

The United States Public Health Service provides a radio medical service from five stations, four of which are on the Atlantic coast and one on the Pacific coast.

Imagine a vessel hundreds of miles out at sea; for many days no other ship has been passed, but the wireless operator has been in touch with several ships, which are miles and miles away beyond the horizon. Suddenly a passenger or a member of the crew is taken seriously ill; there is no doctor on board and medical advice must be had at once.

The captain writes a message and in a few minutes the wireless operator is calling one of the many ships he knows to be within range. The medical officer on the ship replies, giving carefully worded directions for treatment. These directions are always sent in plain language without any technical terms, so a layman has no difficulty in following them.

For several hours the two vessels may exchange messages giving details of the patient's temperature and general condition. Should it be considered that the case is extremely urgent the distant ship may change its course and later come alongside the vessel which has called for assistance; the doctor then goes aboard.

Leg Nearly Blown Off

A single case on record, but one that is the exception rather than the rule, tells of the case where a member of the "black gang" in the stoke-hole aboard a tramp steamer was injured in the exp'osion of a steam pipe. His right leg was almost blown off, and after a day or so of amateur medical attention by the captain of the ship, gangrene set in and the man was in a bad way.

Medical aid was requested by the radio operator but the nearest ship was over 200 miles away and the sailor's condition demanded immediate attention. Unable to secure other aid, the captain wirelessed the doctor on the nearest ship for instructions.

A thorough examination of the patient was made by proxy and, as a result, it developed that an operation would have to be performed. Following instructions to the letter, the captain amputated the seaman's limb and that individual lives to-day to tell the tale.

Hardly a day passes without ships asking for medical advice, and instances have often been reported in the Press. Nevertheless, there are many cases which are not reported in the newspapers, and so the public does not get all those little dramas of the sea.

F. P.

THIS CHRISTMAS!

GIVE THE FAMILY A COSSOR "Melody Maker"

. . . . give them hours and hours of happy entertainment . . . . plays . . . . songs . . . . dance music . . . . vaudeville . . . . endless amusement all through the holidays . . . . *and all next year too!* If your local programme does not appeal to you, at the mere turn of a dial the Cossor Melody Maker will cut out its overpowering transmission like magic and bring you superb Radio music from Madrid . . . . from Paris . . . . from Rome . . . . from Berlin . . . . practically all Europe. Yet this amazing Receiver costs only £7.15.0. You can assemble it yourself without soldering a single wire . . . . without drilling a single hole and you need know nothing about Wireless . . . . it's as simple as Meccano. 90 minutes after you start assembly you will be able to tune in Toulouse . . . . Langenberg . . . . Vienna . . . . wherever your fancy dictates. Get full details of this wonderful Set from your dealer or use the coupon now.

£7-15s.

price includes the three Cossor Valves, the handsome cabinet and even the simple tools—everything necessary to assemble this amazing Receiver.

Will give them many happy hours this Christmas and every day next year as well

Fill in this Coupon NOW

Please send me free of charge a Constructor Envelope which tells me how I can build the Cossor Melody Maker in 90 minutes.

Name.....

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W.M. Jan.

A. C. Cossor Ltd., Melody Department, Highbury Grove, London, N 5

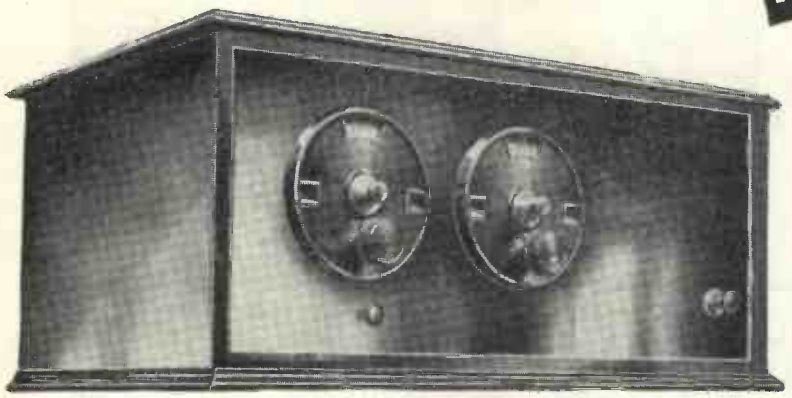
6404 CA

Tuning In Those Foreign Programmes!

"The operation of this receiver will present no difficulty even to the beginner."
(Extract from "W.M." Constructional article)

BETTER IN EVERY WAY

LOW COST
QUALITY
SIMPLICITY
SENSITIVITY
SELECTIVITY
MAXIMUM VOLUME
NO COIL CHANGING
ONE DIAL TUNING



Judge it on quality of reproduction, on volume, on sensitivity to distant stations —judge it by any of the standards of radio receiver performance and you must admit that the Mullard Master 3* is supreme.

The Mullard Master 3* has established itself Britain's favourite receiver. It fulfils every condition for popularity. It is unequalled for all-round efficiency.

You can build the Mullard Master 3* in an hour. No radio experience is necessary; you just mount the components on the printed baseboard in the positions marked and fit the 21 connecting links, obtained ready cut to length and eyeletted. Your finished receiver is equal in appearance and performance to one built by an expert, and you save yourself pounds. Post the coupon now.

To Dept. 8, "RADIO FOR THE MILLION," 63 Lincoln's Inn Fields, London, W.C.2.
Please send me, Simplified Plan of Assembly of the new Mullard Master 3* and Free copy of "RADIO FOR THE MILLION," Vol. 2, No. 4.

Name (Block letters) .....

Address .....

W.M.

The New Mullard Master 3*

Buying At A Distance by C.O.D.

NOTHING is more disheartening for country listeners than to read in the WIRELESS MAGAZINE of new developments and new apparatus, only to find that the one and only radio stores for miles around is many months behind the times. Still more unfortunate are those living away from a town centre, where it is almost impossible to purchase radio goods at all.

Gamut of Facilities

Just as many people do not know the whole gamut of facilities offered by G.P.O. telephones, so also are many ignorant of the fact that the cash-on-delivery postal service in effect brings the big-town radio stores to the country listener's door.

The C.O.D. system has been working for just over two years, and something like a million parcels have been carried by it. Amateurs who reside out of reach of the service area of their local radio dealer would be well advised to order direct from the national dealers and manufacturers who advertise in these pages. Here is a simple explanation of the C.O.D. service.

In the first place, everything transmissible by parcel post (which applies to nearly all radio goods, except accumulators containing loose acid, and so on) can be sent C.O.D. The value of any parcel, up to a maximum of £40, is collected from the addressee by the Post Office and remitted immediately to the sender by means of a special order. The posting is done at any post office in the ordinary way, and parcels may be registered or not, as desired.

Paying the Postman

If the value does not exceed £5, the payment is made direct to the postman bringing the goods, while for value over £5 the addressee receives an advice note telling him at which office the money must be paid.

C.O.D. fees are charged for this service, which, of course, are additional to the ordinary parcels post rates, and vary according to the value of the goods. These are as follows :—

Value not exceeding	*Fee*
10s.	4d.
£1	6d.
£2	8d.
£5	10d.
£10	1s.

and 2d. for each additional £5 (or fraction of £5) up to the maximum of £40. From this list you will see at once the extra charge which you will be required to pay to the sender (unless the apparatus is sent post free), for he has to prepay the ordinary postage and the C.O.D fee.

Any listener in Great Britain and Northern Ireland (including the Channel Islands and the Isle of Man) can take advantage of this method of buying radio parts, but the service does not apply to the Irish Free State in either direction.

If a purchaser still has any doubt as to the way to order some parts C.O.D., he can obtain from almost any post office a leaflet which, while more concerned with the sender's responsibility, will serve as a guide.

An Example

Take one example. You wish to order a three-guinea loud-speaker from Messrs. X, in London. Perhaps you have never seen Mr. X in your life, you have no account with him, and you are not anxious to trust him with your money until you have his loud-speaker in your hand. Moreover, the loud-speaker is not advertised as being post free, and you do not know the amount to remit, for you do not know the postal charge for sending the instrument.

So you simply write to Messrs. X and ask them to forward it C.O.D. The dispatch department attaches to the parcel a label showing your name and address, Messrs. X's address, and the amount of the trade charge (which will include the £3 3s., the parcel post charge, and the C.O.D. fee).

In this case the parcel fee will be 1s. (if the weight of the instrument does not exceed 8 lb.) and the C.O.D. fee, 10d. The total extra cost of obtaining the instrument from Messrs. X in town is thus 1s. 10d., which is probably much less than the return train fare to Messrs. X's showrooms.

Everybody Satisfied

When the parcel arrives you will pay to the postman the cost price, plus the postal and C.O.D. charges. Messrs. X are satisfied because the money is immediately forwarded to them in the form of a "crossed" order similar to a money order. If Messrs. X have no banking account (an unlikely state of affairs) they can have arrangements made to receive the money in cash from the Post Office.

The point which concerns you, as a potential C.O.D. buyer of radio parts, is that the process consists of picking what you want from a catalogue or the advertisements and of dropping a postcard to the firm concerned. That is all. There is no bother of ascertaining postal rates or sending money to firms with which you have not an account.

KENNETH ULLYETT.

A Radio Exam.

PERSONALLY, I have always thought that the solving of general knowledge questions of the "daily five" type was an exercise which John Bunyan would have considered good for the soul. Solving radio questions, likewise, increases one's interest in radio. I suggest that early each morning, having duly performed the "daily dozen," one should try answering a "daily five" radio posers.

Here are some to go on with, and if you can solve them all, then you will be in a good mood to search for others for yourself !

Q.—How many listeners are there at present? (Only licensed listeners, please !)

A.—2,529,364, including yourself.

Q.—At which station did a lady announcer nightly bid listeners "Sleep well"?

A.—Radio Berne.

Q.—Which station occasionally makes announcements in Flemish?

A.—Brussels.

Q.—Can you understand them?

A.—Probably not.

Q.—What do you think of the Programme Board of the B.B.C.?

A.....

(*Please write in block letters on the dotted line.*) QUEUE.

Here is a new receiver that will delight every short-wave enthusiast. Its design has been most carefully thought out—for instance, the fixed vanes of all the variable condensers are at earth potential—and represent the last word in modern practice. Great range is ensured by using a screened-grid high-frequency amplifier.

The Wide-world Short-waver

A THREE-VALVER WITH SCREENED-GRID H.F. STAGE

HAS A WAVELENGTH RANGE OF APPROXIMATELY 15 TO 60 METRES, AND COMPRISES SCREENED-GRID H.F., DETECTOR, AND L.F. STAGE.

USES STANDARD TWO-PIN PLUG-IN COILS

SPECIALLY DESIGNED, BUILT AND TESTED BY THE "WIRELESS MAGAZINE" TECHNICAL STAFF.

POWERFUL AND SIMPLE TO OPERATE EVEN TO A BEGINNER

From left to right are the aerial, anode, and reaction controls

SHORT-WAVE reception never loses its fascination for those who have once received programmes from stations thousands, and sometimes tens of thousands, of miles away. We know that in devoting five pages of the WIRELESS MAGAZINE to the description of a new screened-grid valve short-waver we shall be meeting the needs of a large number of amateurs—and particularly that ever-growing band of "W.M." enthusiasts that is spread over the distant places of the earth.

Most Efficient of Its Type

We make no claims for the range of the Wide-world Short-waver: so much depends in short-wave work on conditions over which the designer has no control. We do say, however, that this set is the most efficient design of its type that it is possible to produce and that it is the result of many months of experience in experimental receivers of the kind.

Opinions Welcomed

There is no doubt that those enthusiasts who build the set will be glad that they have once again let the WIRELESS MAGAZINE Technical Staff guide them, and we shall be glad to hear from constructors their opinions of the set, so that we can publish them in these pages in due course for the guidance of other listeners.

Actually the combination of valves employed in the Wide-world Short-waver is a screened-grid high-frequency amplifier, a leaky-grid detector, and a transformer-coupled stage of low-frequency magnification. Between them, the high-frequency and detector valves ensure adequate range and sensitivity.

Selectivity, of course, is of small moment, for on the very short wavelengths the tuning is so sharp on even what is really an "unselective" set that one hardly knows that the set is not so selective as it might be.

Ordinary two-pin plug-in short-wave coils are used, and with the sizes normally available it is possible to obtain a wavelength of approximately 15 to 60 metres—this, of course, depending on the actual make of coils used.

Aerial Condenser

In order to minimise the effect of aerial capacity as much as possible, a semi-fixed condenser has been inserted in the aerial lead. This condenser has a minimum capacity of .000025 microfarad, so that even if the aerial used is large its effective capacity is reduced to a quite reasonable amount.

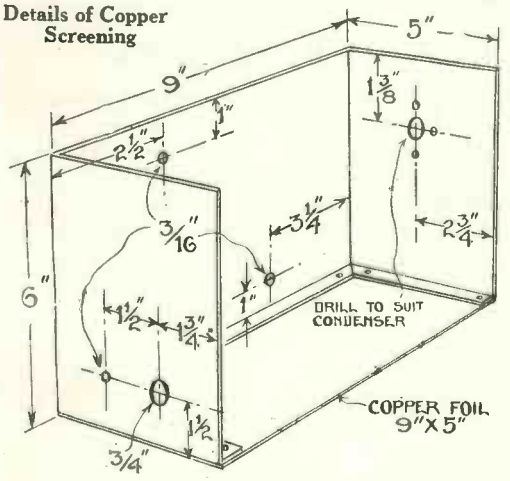
The actual circuit utilised is clear from the diagram reproduced on page 584. From this it will be clear that the aerial and anode circuits are both tuned by .0001-microfarad variable condensers and that reaction is controlled by another .0001-microfarad condenser.

Variable Resistance

In the lead to the screening grid of the high-frequency valve is a variable resistance. This serves two purposes: it gives critical control of the voltage applied to the screening grid and, in conjunction with the 1-microfarad condenser, acts as

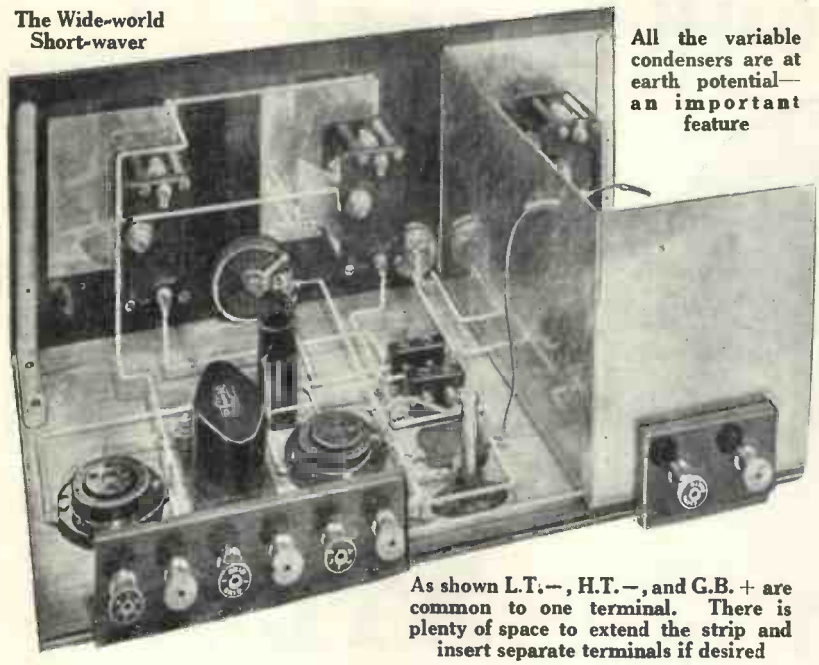
(*Continued on page 584*)

Details of Copper Screening



The Wide-world Short-waver (Continued)

The Wide-world Short-waver



All the variable condensers are at earth potential—an important feature

As shown L.T.—, H.T.—, and G.B.+ are common to one terminal. There is plenty of space to extend the strip and insert separate terminals if desired

a stabilising device. In this way it is possible to apply the same potential to the anodes of all three valves, and even better control of the voltage applied to the screening grid is obtained than if this were provided with a separate feed terminal.

Short-wave Choke

Leaky-grid rectification is carried out by means of a .0002-microfarad fixed condenser and 3-megohm leak. In the anode circuit of the detector valve is a high-frequency choke so that reaction can be obtained; it is essential that this choke should be a real short-wave one, otherwise critical control of reaction will be impossible.

The transformer coupling the detector to the low-frequency amplifier is a standard type, and any good instrument can, of course, be used. A .006-microfarad by-pass condenser is connected across the source of high tension and a master rheostat is used as an on-off switch. So much for purely theoretical considerations.

Arrangement of Controls

On page 582 will be seen a view of the front of the receiver, on which there are respectively three slow-motion dials and two knobs. The dials, from left to right, are aerial tuning, anode tuning, and reaction; while the knobs are those of the variable screening-grid feed resistance and master rheostat.

As far as the operation of the set is concerned, slow-motion dials are essential, and even with a low gearing they must be turned very slowly indeed if stations are not to be missed.

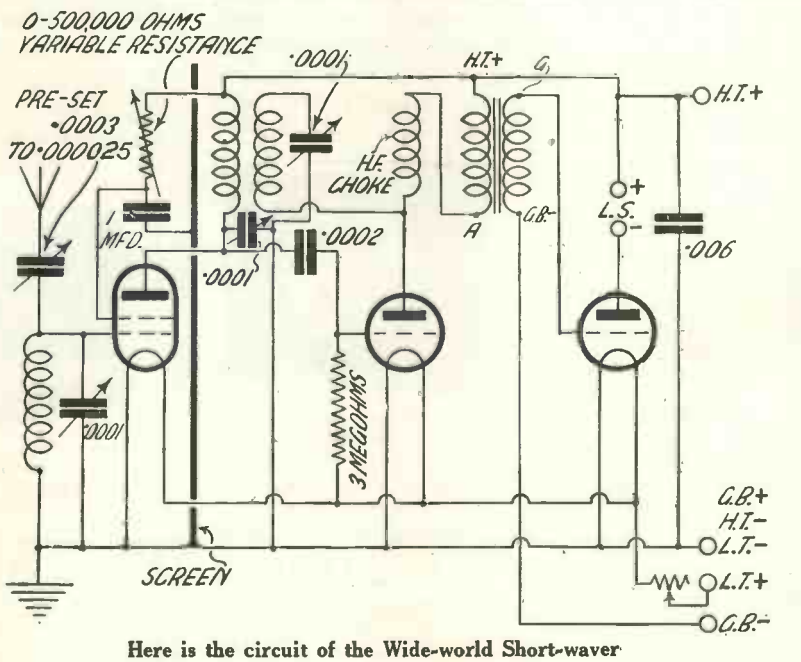
Other features of the Wide-world Short-waver will be clear from the other photographs reproduced in these pages. Special note should be made of the variable condensers. Besides being provided with slow-motion controls, they have also spindles of insulating material and metal screens (which are earthed) to prevent hand-capacity effects. These condensers cannot be substituted without materially affecting the performance of the set.

Simple Copper Shield

It will also be observed that all the components directly associated with the screened-grid amplifying valve are effectively screened from the rest of the receiver by means of a copper shield. This takes the form of a three-sided "box" provided with a bottom which is screwed directly to the baseboard.

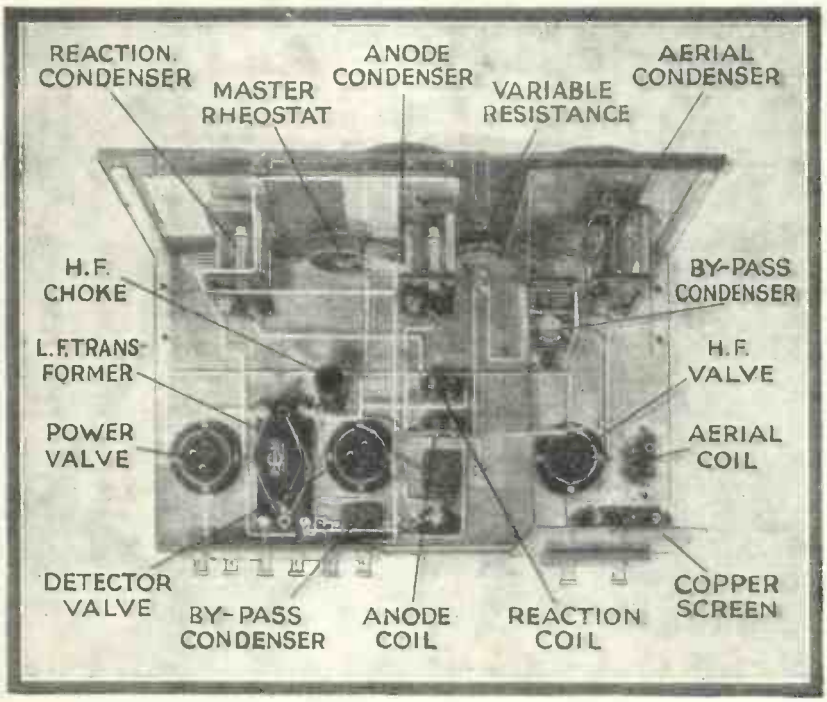
A further point is that the lead from the anode of the screened-grid valve (which is, of course, kept as short as possible) is further protected by a metal covering. This consists of a "winding" of bare copper wire over the insulation and completes the screening afforded by the large copper shield. This "winding" is soldered to the screen.

(Continued on page 586)



Here is the circuit of the Wide-world Short-waver

The Wide-world Short-waver (Continued)



This plan view of the Wide-world Short-waver clearly shows the arrangement of all the parts

Separate terminal strips are provided for (1) the aerial and earth, and (2) battery and loud-speaker terminals. The aerial terminal passes through a clearance hole in the back screen, while the earth terminal is clamped directly to it.

Non-inductive Condensers

In the screened-grid valve compartment is placed the 1-microfarad by-pass condenser associated with the variable feed resistance. This is of the non-inductive type and is of American design. (As far as the WIRELESS MAGAZINE Technical Staff are aware, no British manufacturer makes a non-inductive fixed condenser of this capacity; if anybody does we shall be glad to know.)

Of the remainder of the components, the only two that need be specially mentioned are the high-frequency choke and the low-frequency transformer. It is essential that the choke used should be one specially wound for reception on the waveband between 15 and 100 metres, otherwise the set will be "ploppy."

Avoiding "Ploppiness"

As far as the low-frequency transformer, this is one with the new type of iron core, and its small size in no way denotes inefficiency. With the particular make used it is found best to use a detector valve of moderately high impedance.

From all this the reader will realise that considerable care has been taken to make each part of the circuit as efficient as possible. Tuning condensers with slow-motion dials and anti-capacity shields ensure fine control; the high-frequency circuit makes possible great ranges; while the low-frequency circuit is so arranged to give the greatest volume with the minimum of gear.

Full-size Blueprint

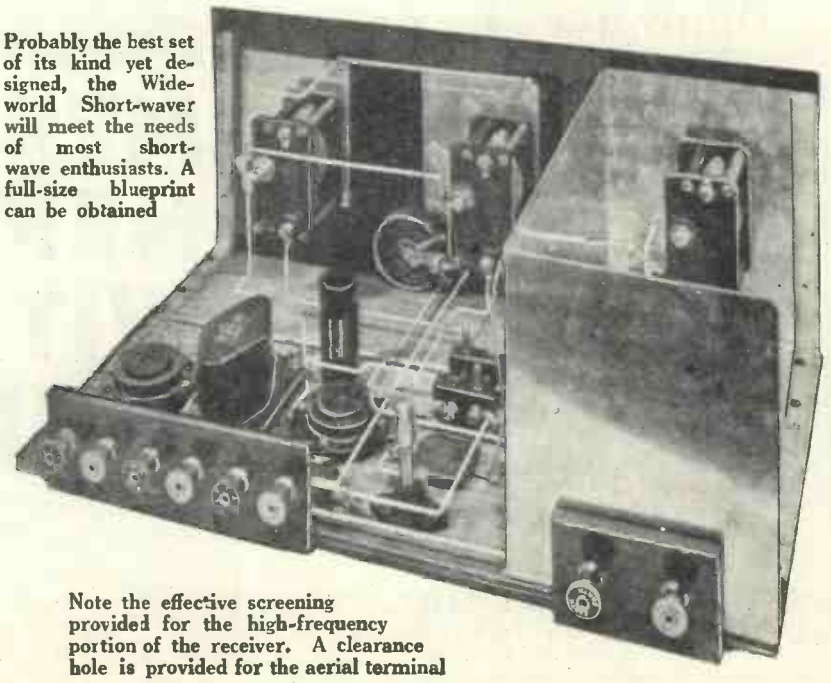
Construction of the set will present no difficulty, even to the beginner, if a full-size blueprint is used. This clearly indicates what holes have to be drilled, how the parts are laid out, and where each wire is placed. Copies of the blueprint are available for half-price (that is, 6d., post free) if the coupon on page iii of the cover is used by January 31 : an extension of time will be made in the case of overseas readers.

Where to Send

Ask for No. W.M. 120 and address your inquiry to Blueprint Department, WIRELESS MAGAZINE, 58/61 Fetter Lane, London, E.C.4. By the way, a blueprint is not absolutely essential, as the details are reproduced on a smaller scale in these pages.

In constructing the set first drill the panel as indicated and then prepare the metal screen, if this is not

(*Continued on page* 588)



Probably the best set of its kind yet designed, the Wide-world Short-waver will meet the needs of most short-wave enthusiasts. A full-size blueprint can be obtained

Note the effective screening provided for the high-frequency portion of the receiver. A clearance hole is provided for the aerial terminal

THE ALL-METAL WAY

is the best way
to build your battery eliminators

NO VALVES NOR ELECTROLYTE are required with

WESTINGHOUSE

Metal Rectifiers

which give full wave rectification with an efficiency of 60%.

TYPE H.T.1.
for incorporation in H.T. eliminator or charger.
Output, 200 v. 100 m.a.
84/-

TYPE H.T.2.
Output, 350 v. 100 m.a.
£8. 8. 0.

TYPE A3.
for incorporation in L.T. eliminator, charger, or for feeding pot-magnets of moving-coil loud-speaker, etc.
Output, 9 volts 1 amp.
PRICE **23/6**

TYPE A4. Similar to above, but with output of 9 volts 2 amps.
Price 39/6

The Westinghouse Brake & Saxby Signal Co., Ltd.
82, York Road, King's Cross London, N.1.

Send 1d. Stamp for our book "THE ALL-METAL WAY," how to build H.T. and L.T. eliminators and chargers.

ALL BRITISH

"BUY DUBILIER COMPONENTS

—and you can count the cost as a NON-recurring one!"

DUBILIER

If unobtainable from your dealer write to us giving his name and address.

DUBILIER
Regd. Trade Mark.

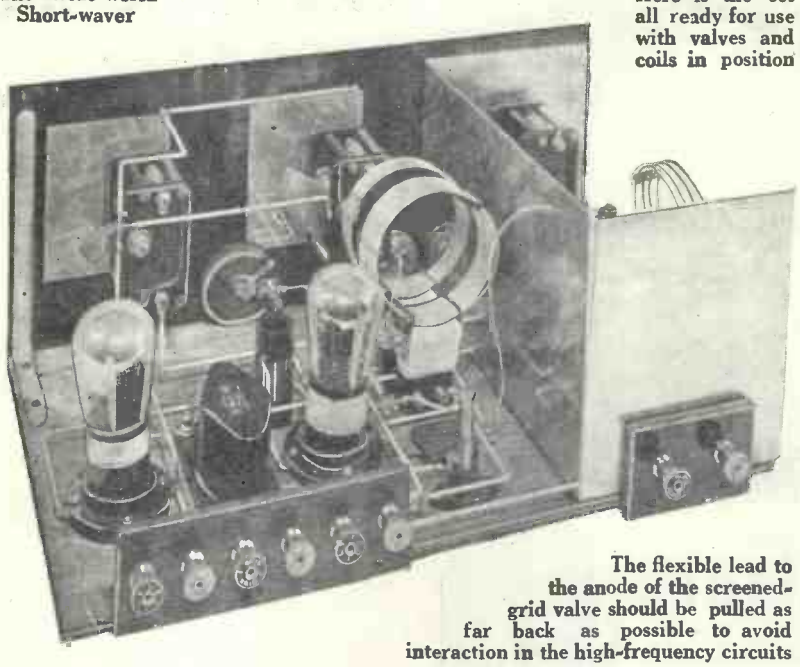
Dubilier for Durability

Advt. of Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, N. Acton, W.3
M200

The Wide-world Short-waver (*Continued*)

The Wide-world Short-waver

Here is the set all ready for use with valves and coils in position



The flexible lead to the anode of the screened-grid valve should be pulled as far back as possible to avoid interaction in the high-frequency circuits

bought ready made from one of the firms indicated in the list of components. Before mounting any of the components fix the panel to the baseboard, with the metal screen in position, not forgetting that the panel bracket on the left is placed over the bottom of the screen.

Layout of the Parts

The layout of the parts will be clear from the photographs and blueprint (or the reduced reproduction on page 590) and no detailed reference will be necessary here.

When all the parts have been assembled, it is time to wire up, and here the blueprint will be found a great time-saver. Each connecting wire is numbered, and leads should be placed in position in proper order. As each connection is made, mark through the number on the blueprint: there is then no fear of going wrong. The wires passing through the screen must, of course, be adequately insulated or damage will be done when the batteries are connected up.

Solder the Joints

Although most of the components are provided with terminals, it is recommended that all joints should be soldered. Any loose connection will result in unpleasant noises being heard during reception.

When the constructor is satisfied that everything is connected up as it should be, a trial can be undertaken. The necessary valves and coils must first be picked out, though.

The screened valve must, of course, be of the upright type; that is, with the anode terminal at the top of the bulb. Although these are being made in 2-, 4-, and 6-volt types, only the first can be obtained at present from most dealers.

Best Detector Valve

It has already been mentioned that a fairly high-impedance valve can be used in the detector stage, and this can actually be of the H.F. type, that is, with an impedance of 30,000 ohms or so. It is not advisable to use a valve with an impedance lower than 10,000 ohms in this position.

Any power valve can be used in the last stage, provided it has an impedance about 2,500 to 5,000 ohms. Anything below that value is unsuitable with most loud-speakers. As a matter of fact, during part of our tests we used a Mullard PM22 (pentode) with some success, for signal strength was considerably increased without the need of adding an extra amplifier. A pentode is not recommended, however, unless the source of high-tension will stand a continuous output of about 20 milli-amperes.

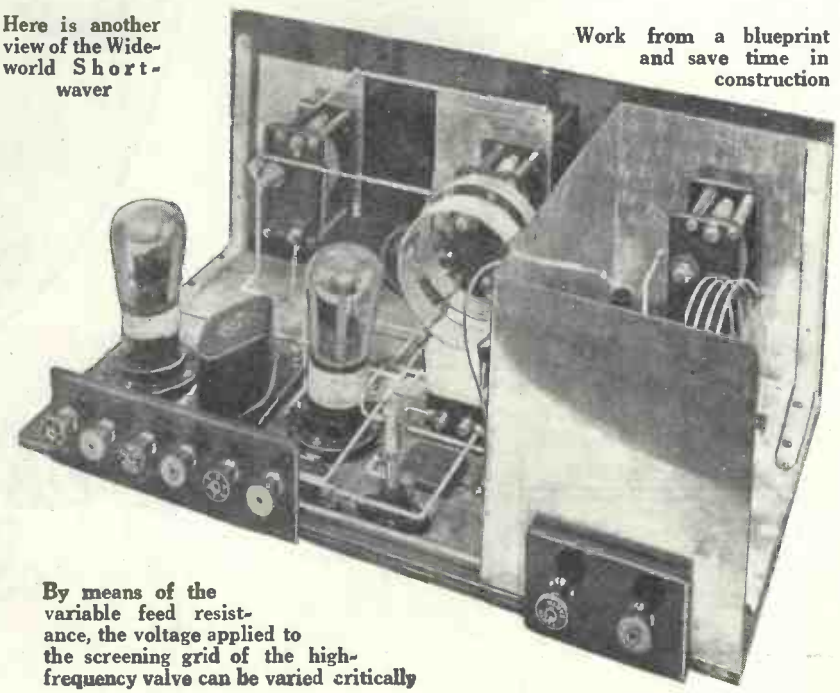
Working from the Mains

It is not recommended that the Wide-world Short-waver should be run from a mains supply unit—in

(*Continued on page* 590)

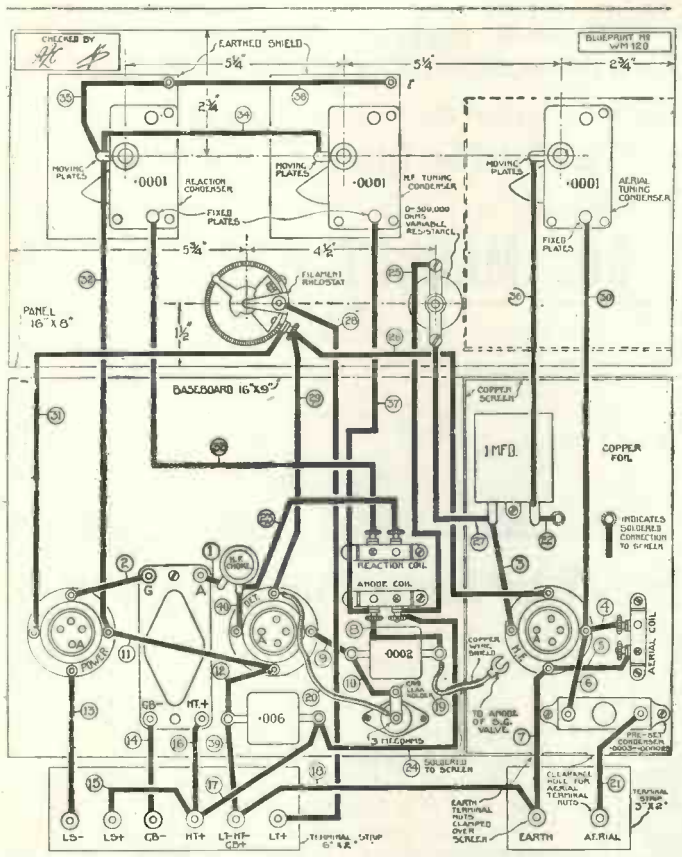
Here is another view of the Wide-world Short-waver

Work from a blueprint and save time in construction



By means of the variable feed resistance, the voltage applied to the screening grid of the high-frequency valve can be varied critically

The Wide-world Short-waver (Continued)



This layout and 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 by January 31. Ask for No. W.M.120

most cases the hum is too loud for comfortable reception. Experiments were tried on a lighting supply that is good as far as hum is concerned, but just on the oscillating point (using headphones for searching) it was found that the hum nearly drowned any signals being received.

Either Atlas or Igranic coils can be used—both firms make two-pin plug-in coils of the same sizes, but they are not interchangeable, as they are wound in opposite directions. For example, if two coils are examined with the plugs on the left it will be seen that the Atlas coils are wound in an anti-clockwise direction, while the Igranic coils are wound in a clockwise direction.

Coils Available

The sizes available of both makes are Nos. 2, 4, 6, and 9. With some aerials—those on the short side—the aerial coil will have to be the same size as the anode coils; in these cases two sets of coils will be needed. Usually it will be found possible to adjust this by means of the pre-set condenser in the aerial lead (see circuit).

To operate the set, insert the necessary valves and coils in their holders. In the case of the screened-grid valve, attach the flexible lead to the anode of the valve and then pull it back as far as possible into the low-frequency section of the set.

Wavelength Ranges with Various Coils

The sizes of coils to be used will depend, of course, on the wavelength range to be covered. Very approximately, the ranges covered by the four sizes of coils available are as follows when shunted with a .0001-microfarad condenser (as in the anode circuit of the Wide-world Short-waver:

No. 2	...	15-20 metres
No. 4	...	20-30 ,,
No. 6	...	30-45 ,,
No. 9	...	40-60 ,,

Normally, the aerial coil must be the same size as the anode coil, but in some cases it will have to be a size smaller. The reaction coil should be a size larger or the same size as the anode coil.

To H.T.+ apply 120 to 150 volts and to G.B.— the bias recommended by the makers of the last valve. It will be observed that L.T.—, H.T.—, and G.B.+ are common to the same terminal.

How to Operate the Receiver

Turn on the master rheostat and adjust the variable resistance in the screening-grid circuit until the set sounds really "live" (searching with headphones, of course, at first). Now turn the knob of the reaction condenser, on the right of the panel, until the slight hissing or rustling sound is heard which indicates that the set is on the verge of oscillation and therefore in its most sensitive condition for reception.

Very carefully and slowly (for even with slow-motion dials and the small-capacity condensers used tuning is extraordinarily sharp) turn the dials of the anode and

(Continued on next page)

COMPONENTS REQUIRED for the WIDE-WORLD SHORT-WAVER

1—Ebonite panel, 16 in. by 8 in. (Radion, Becol, or Parfait).
3—.0001-microfarad short-wave condensers with slow-motion dials (Burndept).
1—0 to 500,000-ohm variable resistance (Clarostat).
1—15-ohm panel rheostat (Lissen, Gecophone, or Peerless).
3—Anti-microphonic valve holders (Lotus, W.B., or Igranic).
3—Single-coil holders (Lotus, Magnum, or Peto-Scott).
1—Semi-variable condenser, .0003 to .000025-microfarad (Formodenser).
1—1-microfarad fixed condenser (Hunt's Polymet).
1—.0002-microfarad fixed condenser (Hunt's Polymet).
1—3-megohm grid leak with holder (Dubilier, Ediswan, or Mullard).
1—.006-microfarad fixed condenser (Hunt's Polymet).
1—Short-wave high-frequency choke (Igranic or Bulgin).
1—Low-frequency transformer (Mullard).
2—Terminal strips, 6 in. by 2 in. and 3 in. by 2 in. (Radion, Becol, or Parfait)
8—Terminals, marked:—Aerial, Earth, H.T.+, L.T.+, L.T.—, G.B.—, L.S.+, L.S.— (Eelex, or Belling-Lee).
1—Copper screen (Parex or Ready Radio).
1—Cabinet with 9 in. baseboard (Caxton).
1—Set short-wave plug-in coils (Atlas or Igranic).
1—Pair panel brackets (Bulgin).

The Wide-world Short-waver
(Continued)

aerial condensers until the two circuits are in tune; this is denoted by an increase in the strength of the rustling or hissing sound already audible.

As soon as the point has been found where the two circuits are in tune, go round the dials, keeping both condensers in step, as it were. It will also be necessary to readjust the reaction condenser for every few degrees the tuning condensers are moved.

Tune Slowly and Carefully

However, a few minutes' practical experience of the set will help the constructor more than pages of explanation. *Remember that tuning must be done very slowly and critically*, otherwise stations will be passed over.

Even with such a powerful set as the Wide-world Short-waver it is not always possible to hear American stations when atmospheric conditions are bad, but whenever the set is switched on it is probable that morse signals will be heard. These provide some standard for reaction adjustments and the variation of voltage applied to the screening grid of the high-frequency valve.

B.B.C. Short-wave Station

By the way, constructors must not be surprised if 5SW—the B.B.C.'s short-wave station at Chelmsford—is picked up only at very poor strength. This station is within the "skip" distance of short waves for most southern parts, and theoretically should not be heard at all. When it is picked up it will, however, act as a guide to the wavelength to which the set is tuned—it works on 24 metres.

Lately, however, we have had good results on the Wide-world Short-waver from this station when it was testing on approximately 25 to 26 metres.

LET US HAVE YOUR OPINION OF THIS OR ANY OTHER "W.M." SET THAT YOU BUILD!

Broadcast Music of the Month

Elsie and Doris Waters

THE year's programmes have probably found many "discontents" amongst listeners, and there is no doubt that the tendency to swing from highbrow to jazz and negroid performers has caused many people to forsake their wireless sets for the more catholic gramophone. Greater diversity of schemes, however, has marked this month.

Orchestral Concerts

Two big orchestral concerts mark the month's classical programmes—that by the Hallé Orchestra relayed from Manchester and the National Symphony Concert at Queen's Hall. Two unfamiliar works were included in the former—the Sinfonia No. 2 in F flat by Philip Emanuel Bach, and Dvorak's Fourth Symphony in G.

Frank Newman, organist

concert announced to be conducted by Franz von Hoesslin, the conductor of the Festival Theatre at Bayreuth, was practically a Wagner programme, the chief items being the Siegfried Idyll, the Good Friday Music, and the overtures to *Tannhauser* and *The Meistersingers*.

The latter work was also drawn upon for the National Orchestra of Wales concert at Cardiff, at which, in addition to the fine choir of seventy voices, famous soloists included May Blyth, William Michael, and Parry Jones.

Amongst the military bands, many programmes of interest have been carried out under John Ansel, Walton O'Donnell, and Flight-Lieutenant J. Amers (conductor of the R.A.F. Band).

Many famous instrumentalists have also figured prominently. Most listeners will miss the fine work of Myra Hess, the pianist, and the Hungarian violinist, Jelly d'Aranyi, who have left England for a world tour after giving a farewell performance.

Daisy Kennedy, Isolde Menges, Adila Fachiri, Johanne Stockmarr, the pianist, Harold Samuel, W. H. Squire, 'celloist, and another brilliant young violinist, Yovanovitch Bratza, are but a few of the great names in this month's programmes.

Instrumentalists

Round the stations many excellent instrumentalists have been heard. Don Hyden's name is well known at the Manchester station particularly, and he has broadcast from 2LO as well. From Newcastle is often heard Olive Tomlinson, while welcome appearances have been made by those two early broadcasters, Winifred Small and Maurice Cole.

Olive Tomlinson

Naturally, the number of singers is overwhelmingly large, and it is difficult to make a choice where so many have proved more than equal to their ordeal of facing the microphone. Many old and tried favourites have been heard, including the great operatic

(*Continued on page* 594)

George Buck, singer

Frank Foxon, baritone

POLAR CLARICONE

WHAT USERS SAY ABOUT THE POLAR CLARICONE

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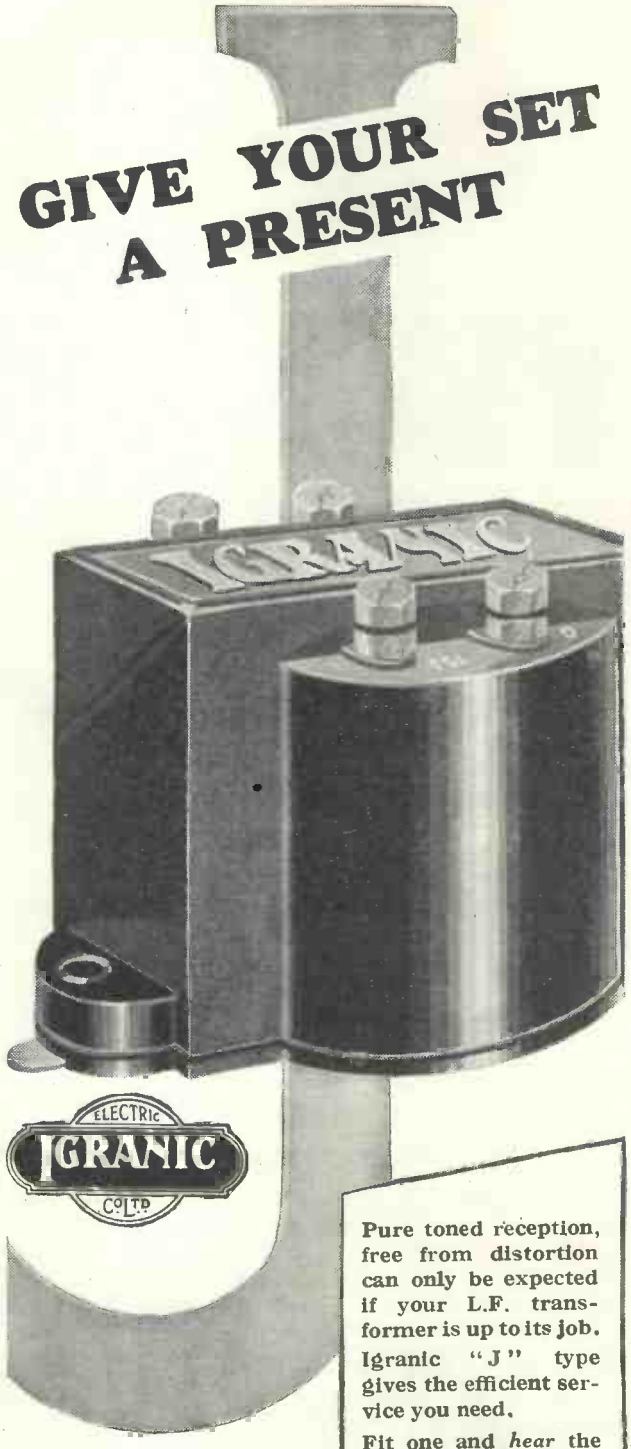

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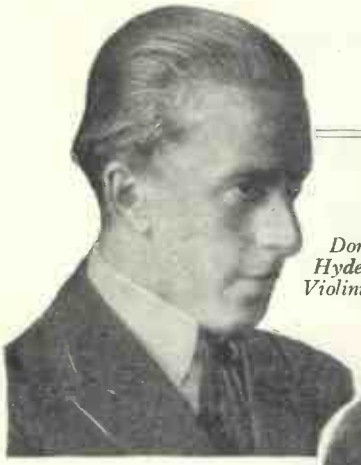
Broadcast Music of the Month (Continued)



Don Hyden Violinist

artists such as Miriam Licette, George Parker, Astra Desmond, Edith Furmedge, Walter Widdop, Dennis Noble, and Horace Stevens.

Mention, too, must be made of Sir George Henschel, the veteran singer of seventy-eight, whose operetta, *A Sea Change*, or *Love's Stowaway*, written some thirty-five years ago, was produced early in the month. One is always glad to hear one of the finest of our tenors, Leonard Gowings, and Roy Henderson, Gladys Ancrum (of the B.N.O.C.) and Ben Williams (of the Carl Rosa), who, with Helen Ogilvie, was heard last month in the relay of the opera *Faust*.

Doris Gambell

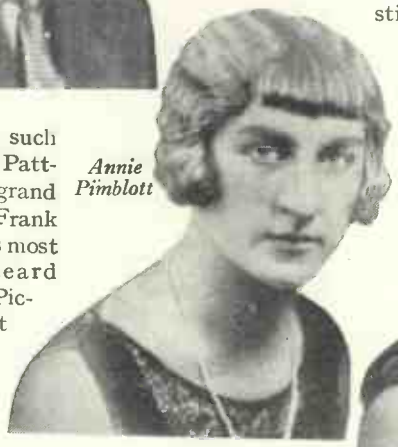
Bobby Blythe

In the Provinces

Many singers are best known in the provinces. Steuart Wilson was heard at Glasgow in the Choral and Orchestra Union of Scotland; Doris Gambell at Manchester; while other names include Betty Berri, Annie Pimblott, April Pendarvis, George Buck, Bobby Blythe, Alec Shanks, and Frank Foxon, a Sheffield vocalist.

Community singing by radio is a feature also that has "caught on," and the title of "Fireside Singing" for the recital from 5GB was distinctly popular.

Although not really the best medium for broadcasting, in the hands of really skilled artists the grand effects of "the king of instruments" come over exceedingly well. This has been proved throughout the year by such musicians as Pattman, on the grand Astoria organ; Frank Newman, who is most frequently heard from Lozells Picture House at Birmingham; Edward O'Henry, the organist at Tussaud's Cinema; and, of course, the various church organs.



Annie Pimblott

April Pendarvis

A recital announced of special interest to organ-lovers was that of December 7, when the organ at Liverpool Cathedral—the largest of its kind in the world—was given by a favourite wireless organist, Goss Custard.

Variety is the most important feature of the programmes to the general public, for laughter is a much-needed tonic in these dreary days—a point which the B.B.C. sometimes appears to forget. Luckily, we have been able to hear many well-known revue and music-hall stars. Some Palladium relays have been given, and appearances made by such well-known stars as Cicely Courtneidge and Harry Hemsley, the best child impersonator on the stage.

Mabel France

Variety Stars

Tommy Handley is, of course, a host in himself, and his own conception of a Christmas menu ought to be promptly recorded, so as to be handed down to the next generation or so. The Duncan Sisters, with Gracie Fields substituted on the last occasion owing to the illness of Rosetta; Clarice Mayne, one of the very few artists who can give a really life-like impersonation of some of the old music-hall stars; Julian Rose; and Wolesey Charles, one

(*Continued on next page*)

Edward O'Henry, organist at Tussaud's Cinema

Broadcast Music of the Month *(Continued)*

of the first "Co-Optimists"; Gwen Farrar and Billy Mayerl; Norah Delaney and John Henry—these are all names to conjure with and warranted to fight off the bluest of blues.

Capital entertainers, too, frequently heard from all stations are Leonie Lascelles and Jean Paul; also

Alec Shanks, baritone

a clever pair of sisters—and really sisters, too—Elsie and Doris Waters, whose violin solos, stories, and songs in dialect have held both drawing-room and Queen's Hall audiences enraptured.

Clapham and Dwyer, Mabel France with her sketches of "Aunt Maria," and Pursall and Stanbury are all clever entertainers.

Wish Wynne, Fred Beck, and George Stockwin and Thorneley Dodge have also been heartily welcome.

Frankly, it is in the dramatic section that most changes are required.

Pursall and Stanbury, entertainers

The B.B.C. in 1928 (*Continued from page 544*)

of Jedburgh. The speech was broadcast from the Scottish stations and relayed to Daventry 5GB.

Broadcast Pictures

The first of the series of experimental transmissions of "still" pictures outside programme hours took place on October 30, transmissions being continued daily from Tuesday to Saturday inclusive. An attempt was made on November 10 to relay from Sydney greetings from members of the M.C.C. team, who broadcast from the Sydney station, 2ME. Unfortunately, a vast amount of atmospherics prevented successful reception, and the relay was not by any means among the best that the B.B.C. has handled.

From November 1 onwards various changes were introduced in stations' wavelengths in an attempt to overcome heterodyne interference. Pending the introduction of the regional scheme, rather than withdraw the relay stations, an attempt was made to revive their usefulness by the expedient of single wavelength working. As a step towards the development of regional programmes also, the Nottingham transmitter was taken out of service on November 1, Nottingham listeners taking their place with Birmingham listeners in the service area of Daventry 5GB.

Group programmes were simultaneously developed, the programmes being composed mainly of material from the regional centres—Manchester, Glasgow, and Cardiff. The arrangements were necessarily experimental, designed to supplement the service during the interim period which must elapse before the new regional system of high-power stations is fully inaugurated.

Chief Event of the Year

The chief event of the year was, of course, the broadcasting of the Armistice Day Service from the Cenotaph, which included band music as well as the memorial service. The ceremony was broadcast also from the Chelmsford short-wave station. The British Legion's annual service was also relayed from the Cenotaph on Whitsun Day.

At the moment of going to press, negotiations were in progress for a broadcast by the Queen on the occasion of the unveiling of the War Memorial of the Merchant Navy and Fishing Fleets at Tower Hill, London, on December 12.

A running commentary on the fight between Tunney and Heeney at the Yankee Stadium, New York, was picked up at the Keston receiving station in the early hours of July 27 and broadcast from 2LO and Daventry 5XX. The relay was a complete success, as was also the relay of the running commentary from Lakehurst of the arrival of the Graf Zeppelin on October 15. For the latter reception the new spaced aerial system installed at Tarling, near Chelmsford, was used, and technical opinion was that this system marked a distinct advance in the elimination of fading and atmospherics.

Clear Relay

From the first remark of the American announcer, "She is within a mile now, and we shall soon hear the motors," right to the end of the broadcast the commentary was as clear as if the transmission were taking place direct from the B.B.C. stations. Not the least novel incident in connection with this broadcast was that listeners had no preliminary notice that it was to take place, the ordinary programme being interrupted at 10.15 p.m. and the relay from Lakehurst starting thirty seconds later.

On July 13 a new feature was introduced into the Friday programmes, consisting of a "surprise" item broadcast once a week from London at 10.45 p.m. The surprise items are not announced beforehand and each week an attempt is made to present a distinct novelty. On August 10, for instance, the broadcast took place from a signal box at King's Cross; on September 14 Jack Hobbs and other members of the M.C.C. team broadcast "*au revoir*" on the eve of their departure for Australia.

Another surprise item was the appearance of the well-known Continental radio artist, Bilboquet, who broadcasts regularly from Radio-Paris.

For the first time in the history of broadcasting, a performance was broadcast from the stage of the Palladium, London, on October 22. This has been succeeded by others from the Palladium stage, Jackie Coogan, Van and Schenck, and Naughton and Gold being among the artists whose ordinary turns have been heard simultaneously by listeners throughout Great Britain.

Number of Listeners

On October 31, 1928, the total number of licences in force was 2,529,364, marking an increase over the twelve months of 191,631. This figure does not include the number of licences issued free to blind listeners, 13,594 being in issue at October 31, 1928.

Several broadcasts by the King took place during the year. On October 10 he performed the opening ceremony of the new Tyne Bridge and on July 10 His Majesty spoke in connection with the opening of the New University Buildings at Nottingham.

Frame-aerial Facts

FRAME aerials are coming rather to the fore again now that screened-grid valves and better means of H.F. amplification are available. Apart from their use in portables, they are popular with the owners of fairly expensive transportables who dislike trailing an aerial lead-in from room to room.

Ghastly Examples

Nevertheless, I have recently come across some really ghastly examples of frames, and I suppose they must be excused by the fact that their constructors have never before had occasion to use aerials of the "pocket handkerchief" type.

Here are some facts about frames on which to work when building a frame aerial.

The signal current produced in the windings of a frame is proportional to (amongst other things) the dimensions and the number of turns of wire. It is also inversely proportional to the wavelength.

It is really bad practice to put on the turns of wire pile-fashion, with-

out making any attempts at accurate spacing, and the wire itself should be of fairly thick gauge and well insulated. Litz wire is particularly suitable, for the multi-strand formation cuts down the high-frequency resistance.

As Large As Possible

Within reason, the aerial should be as large as possible, even though this necessitates the frame members being collapsible in order that the whole thing may be portable when required. When a small number of turns allows it, the turns should be spaced about ⅛ in., and the corners of the cross-members, round which the wires pass, should be insulated. The "in" and "out" leads to the frame winding should be well separated.

B. E. S. S.

Television Failures

HAVE you by any chance a photographic failure amongst your friends? You know what I mean—a person who has the kind of face which never comes out well in a photograph. Perhaps you have tried to photograph such a person in the hope that you would succeed where others have failed.

Well, the problem of the photographic failure seems to have its counterpart in television, for it has been found in America that certain faces cannot be televised successfully. Nobody seems to know why one face should televise well over there and another face should televise badly.

Of course, television is in a very crude state at present, but even when television has made rapid strides towards perfection, television failures will doubtless remain an unsolved problem.

Eye-glasses

One interesting thing reported from America is that the face of a person wearing eye-glasses cannot be televised because of the reflection of the glasses. Another interesting thing reported is that the successful television of a lady depends very largely on the kind of hat the subject is wearing.

A lady wearing a large hat becomes lost in transmission. The hat must be small or, better still, the lady must be without a hat for television purposes.

AERIAL.

A supplement devoted to the interests of gramophone enthusiasts who wish to use electrical reproducing methods

Wireless Magazine

Contributions to this Section are invited, will be promptly considered and, if used, will, of course be paid for

GRAMO-RADIO SECTION

The First Supplement of its kind to be Published

Damping in Pick-ups

By J. H. REYNER, B.Sc., A.M.I.E.E.

AN expert in radio gramophonics will talk about a pick-up being nicely damped or too heavily damped, or whatever it may be. The uninitiated user may wonder exactly what this damping is and how it affects the quality of reproduction, since his principal test of the usefulness of any particular pick-up is whether it gives good quality or not and whether it is reasonably light on the record and does not cause excessive wear.

Restraining Influence

Damping as applied to pick-ups refers to the restraining influence exerted on the movement to prevent excessive freedom of motion. Theoretically, damping should be of such a nature that it allows the mechanism to move under an applied force with absolute faithfulness, while preventing any natural tendency to oscillate or vibrate. This, unfortunately, is an ideal state of affairs at which we can only aim by various practical expedients.

Record Grooves

The record to be played carries a groove upon which are impressed side to side variations. These deviations from the normal spiral route are imparted to the needle of the pick-up, and in turn the movement of an armature produces the electrical currents applied to the amplifier.

Variations on the record are of manifold frequencies and amplitude, and the perfect pick-up should follow the variations absolutely faithfully, be they large or small, rapid or slow. Actually, it does not do so, but it can be made to approximate to the ideal condition by careful attention to details.

The mechanism itself has a certain natural period of vibration. In fact, it usually has more than one occurring at different portions of the frequency range. If the vibrations on the record coincide with this natural frequency of the movement, then a building-up or resonance effect will take place and the mechanism will continue to vibrate after the applied force has ceased.

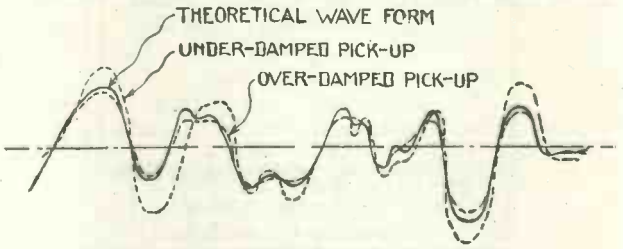
Thus, if the record plays the particular resonant note and then changes the pitch to some other note, the pick-up mechanism will tend to continue vibrating at the original note, which will have two bad effects.

In the first place, it will produce an unpleasant resonant effect aurally and, secondly, it will tend to destroy the record for the portion immediately following the resonant point.

Cutting the Record

The needle itself will be vibrating on its own accord, and will not be following the needle track, so that it will be acting as a cutter rather than a follower, and this will wear down the sides of the track, and in time will cause the needle to jump from one track to the next at this particular point.

To overcome this trouble, damping is applied to the pick-up. This is restraint on the motion of the needle which prevents it from vibrating freely at its natural or resonant period. It is in the application of this damping that the skill of the designer comes, for, as we said at first, theoretically the damping should only restrict the resonant or free vibrations, and should not affect the movement of the mechanism under an applied force.



[EFFECT OF DAMPING IN A PICK-UP]
The dotted lines show the effect on the true wave-form of under-damped and over-damped pick-ups

Ingenuity Needed

The two conditions are mechanically incompatible and no little ingenuity is expended in achieving a practical compromise.

(*Continued on page* 600)

Damping in Pick-ups : By J. H. Reyner *(Continued)*

One of the most common forms of damping is by packing the mechanism with rubber in some manner. By using a very soft and spongy type of rubber, any natural vibration is very rapidly damped out, but under the pressure of an applied force the mechanism can yield and vibrate at the correct frequency and amplitude.

Losing the Higher Harmonics

It is clearly necessary, however, that the damping shall be of the correct order. If it is too light, then we do not entirely damp out the natural vibration of the mechanism, and if it is too heavy we distort the vibration and tend to lose the higher harmonics, which give life to the reproduction.

This point is illustrated in the diagram, where a wave-form of an imaginary shape is represented by the full line. The first dotted line represents the effect of an under-damped pick-up mechanism, assuming that the frequency is somewhere about the resonant value. It will be seen that the pick-up rapidly rises to the high values and tends to maintain its oscillation beyond the correct limits, the chatter or over-shooting of the parts being clearly in evidence.

Effect of Over-damping

The second dotted line illustrates the effect of an over-damped pick-up, the restraint being too heavy in this instance, so that the pick-up mechanism cannot follow each vibration in a satisfactory degree. The acceleration of the mechanism is retarded and the minor variations are almost entirely damped out.

Clearly, both of these conditions are undesirable, not only from the electrical point of view, but from the mechanical. Electrically, under-damping will give resonant effects, while over-damping will cause loss of brilliance. Mechanically, both effects will result in increased wear of the record.

The under-damped pick-up will cause trouble due to chatter, while the over-damped arrangement will not respond to very rapid deviations in the needle track, and consequently the walls of the track will be worn away at these points; so that the record will, in time, cease to produce the minor variations of light and shade, whatever pick-up is employed.

It will be seen from these remarks that the matter of damping is a very critical one and that considerable trouble is to be expended in obtaining satisfactory results. Rubber is very commonly used for damping, and, if a good quality rubber can be obtained, this is a satisfactory method.

Difficulties with Rubber

It is subject, however, to deterioration, owing to the perishing of the rubber, and in time the motion may become quite hard and almost rigid, in which case the wear on the record will be very serious. Another difficulty with rubber is that of maintaining uniformity. Having gauged the exact thickness of rubber required, it is a matter of some difficulty in production to ensure that every pick-up made shall have exactly the same thickness of rubber in the damping arrangement.

In an attempt to overcome these difficulties, oil-damped pick-ups have been suggested. Here the mechanism is attached to a small dash-pot arrangement, so that there is no restraining force brought into play until the mechanism actually moves. It can thus get off the mark quickly, but will immediately be damped should it endeavour to oscillate at a natural period of its own.

Very intricate systems have been devised on these lines and a certain measure of success has resulted. The cost, however, is usually prohibitive, and it is only in very high-grade instruments that such systems can be afforded.

Electromagnetic Methods

Electromagnetic damping is another method which has not, perhaps, received the attention which it deserves. This, theoretically, is a good method, for there is no mechanical friction involved. The motion of the pick-up armature is caused to produce eddy currents in a piece of metal, and the forces developed automatically restrict the motion of the armature. By satisfactory design, these forces can be so graded that they just keep the armature critically damped. As there is no mechanical friction, there is no time lag in operation.

The pick-up comes into operation at once and the damping is actually proportional to the amplitude of the vibration. Thus, on the very rapid but small-amplitude harmonical vibrations, damping is not heavy, unless the oscillation builds up, due to a resonance effect, in which case it would immediately be checked.

An Important Question

There can be no doubt, therefore, that this question of damping is a most important one and that a great deal of development work will take place in the near future. It is a point which well repays study, and by careful listening to the results, combined with an examination of the record itself, it is fairly easy to decide whether a pick-up is under, over, or correctly damped.

Is There Anything Special You Want to Know About Gramo-Radio?

Whatever you want to know about Gramo-Radio, consult the "Wireless Magazine" Technical Staff. For many months they have kept abreast of this latest development and can reply to any query that may be raised in connection with it.

If your pick-up does not give the results you think it should—if your amplifier is not quite distortionless—in fact, if you are in trouble of any sort, the Technical Staff can put you on the right track.

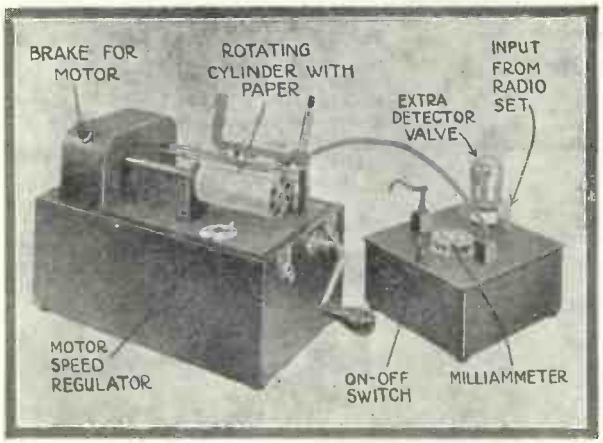
So that the Staff is not absolutely overwhelmed with queries (and to avoid the trouble of answering any of a frivolous nature, which results from a free service) a nominal fee of 1s. is charged for every two questions asked.

Write your query or queries (not more than two can be answered for each reader) on one side of a sheet of paper and send it, together with a stamped addressed envelope, a postal order for 1s. and the coupon from page iii of the cover, to Gramo-Radio Queries, "Wireless Magazine," 58/61 Fetter Lane, E.C.4.

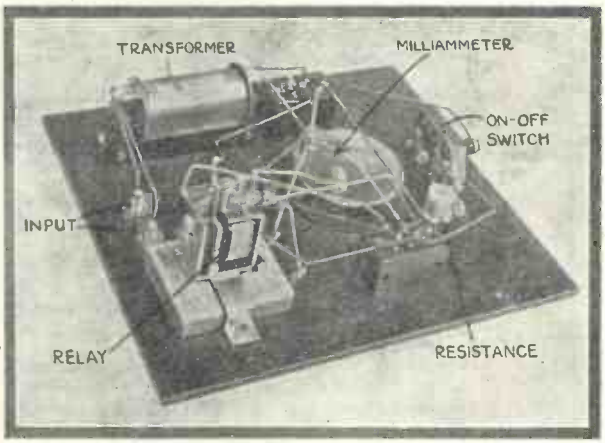
Wireless Magazine, January, 1929

How the Fultograph Works

Further Notes by D. SISSON RELPH



View of the Fultograph picture-receiving apparatus. On the left is the picture-receiver proper, with the relay unit on the right



Here is an underneath view of the relay unit, which plays an important part in the operation of the apparatus; this will be clear from the circuit diagrams

LAST month in the article entitled "How to Receive Wireless Pictures" some hints on the actual working of the Fultograph picture receiver were given. Here we are able to reproduce circuit diagrams of the complete apparatus—that is, of both the picture receiver itself and also of the relay unit.

Actual Circuits

The circuits were actually traced from a receiver in our possession, although we believe that they have been slightly modified in recently issued models. However, the principle of operation remains the same.

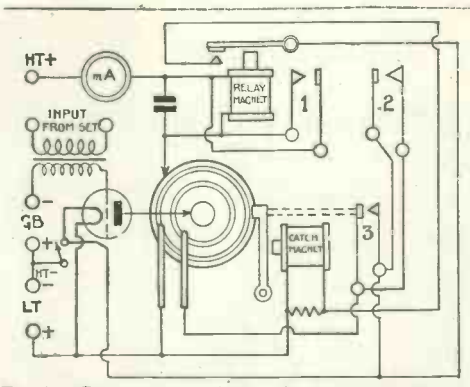


Fig. 1.—Connections while cylinder is stationary and before first synchronising impulse is received

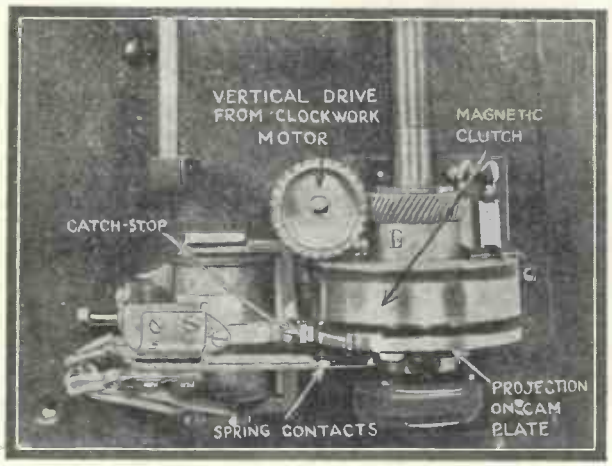
There will be little difficulty in recognising the various switch contacts shown diagrammatically in the photographs also reproduced in these pages.

Three Operating Positions

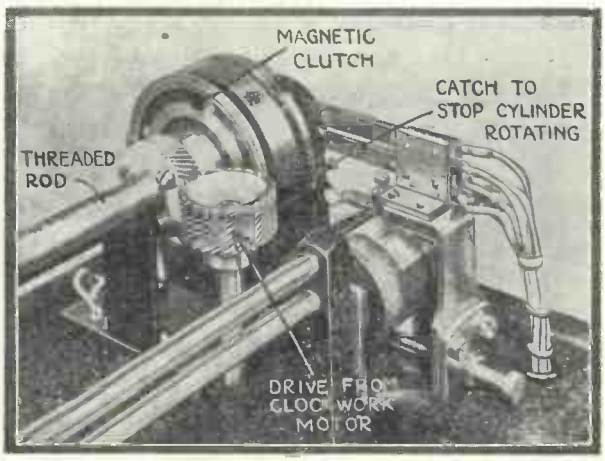
It will be remembered that there are three different stages in the operation of the Fultograph machine. Before the first synchronising signal is received the cylinder is held stationary by means of a catch-stop and of course, the relay circuit is broken. This is indicated by Fig. 1.

Then as soon as the first signal is received the relay is closed and a local circuit energises the armature coil associated with the

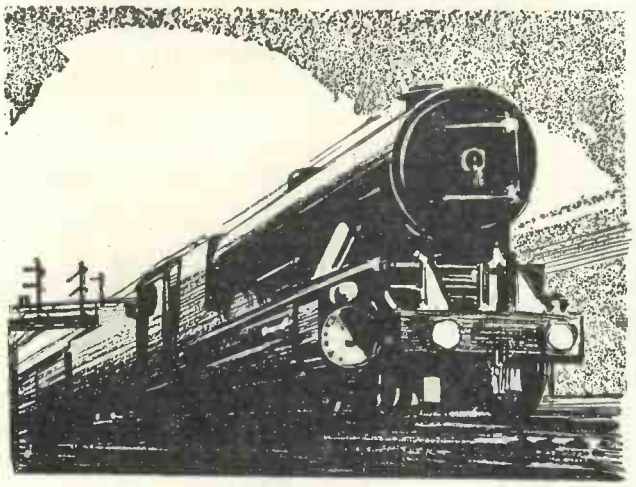
(*Continued on page* 604)



Plan view of the spring contacts and cam plate at one end of axis which carries reproducing cylinder at the other end



Another view of the spring contacts and magnetic clutch. Note also the catch-stop with its associated field coil



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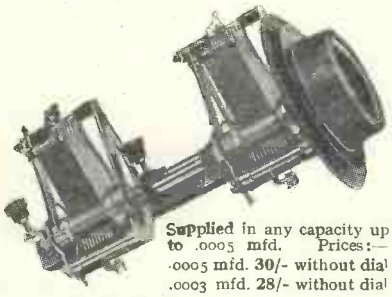
The Condensers are efficiently and completely insulated from each other and are well spaced apart—they may be easily screened if desired.

One-hole fixing—a support provided for rear end. Particularly suited for use with either J.B. Drum Dial, or J.B. Vernier Dial.



Supplied in any capacity up to .0005 mfd. Prices:—
.0005 mfd. 30/- without dial
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As used by Mr. James in his "Touchstone" Receiver.

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How the Fultograph Works (Continued from page 602)

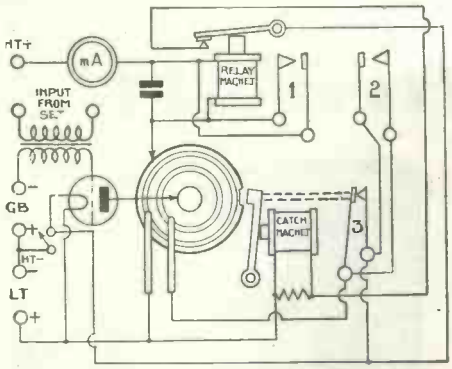


Fig. 2.—Connections of the apparatus when first synchronising signal is received and cylinder starts rotating

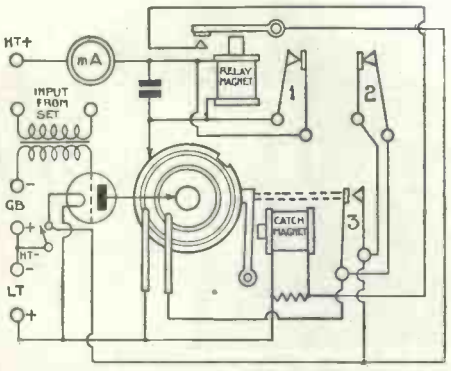


Fig. 3.—Connections while the cylinder is rotating and "picture" currents are passing through the cylinder and stylus

catch-stop, which is instantaneously withdrawn and the cylinder starts to revolve.

At the same time that the catch-stop is withdrawn from the slot in the disc at one end of the cylinder, it closes the clutch circuit, which takes up the drive from the clock-work motor. This will be clear from Fig. 2, where it will be seen that contact 3 is closed.

Parallel Contacts

When the cylinder is revolving the clutch circuit is closed through contact 2, which is in parallel with contact 3 and which is actuated by the spring contacts touching the cam plate (see Fig. 3).

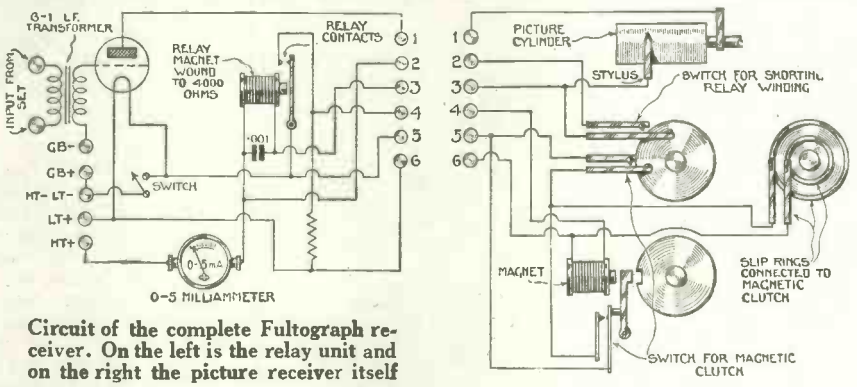
It will also be observed that while the cylinder is revolving the relay is short-circuited by contact 1, which is also actuated by spring contacts touching the cam plate.

Until the cylinder starts rotating it will be noticed that no current passes through the stylus as the earthed path between the anode of the rectifying valve and the projections on the cam plate has a lower resistance.

When the Cylinder Revolves

When the cylinder starts revolving, however, this earthed circuit is broken and current flows from the anode of the valve, through the cylinder and stylus and thus to the high-tension source. In this way the picture is reproduced as the small pulses of current stain the paper and so gradually build up a composite image.

From these few remarks readers will appreciate the ingenuity displayed by the inventors.



Circuit of the complete Fultograph receiver. On the left is the relay unit and on the right the picture receiver itself

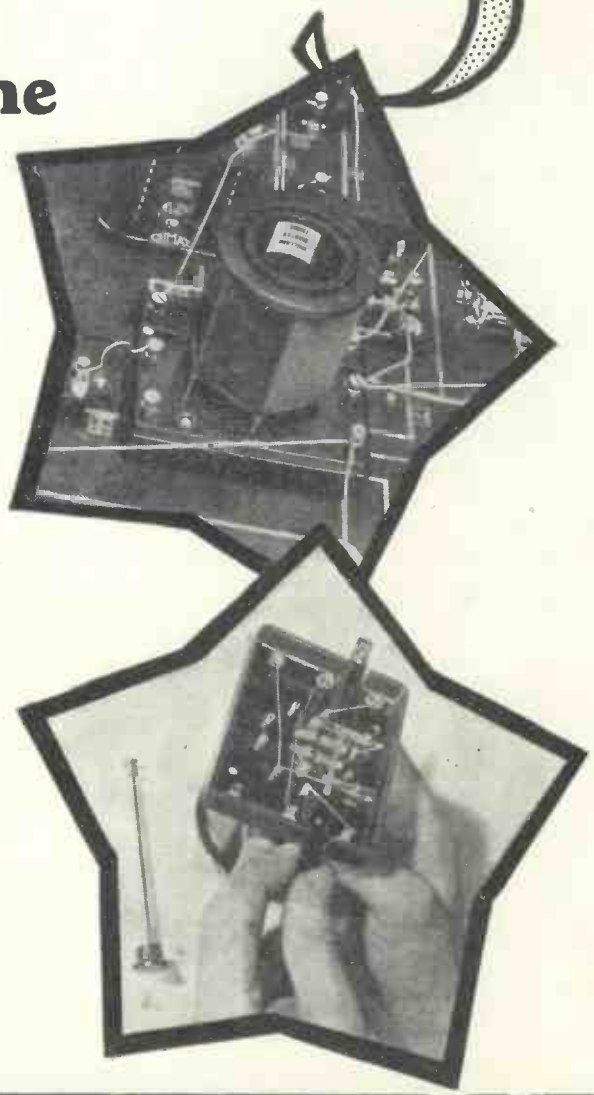
As specified for the new — Mullard Master 3

The Colvern Combined Wave Coil gives selectivity and volume

THE fact that coil-changing is dispensed with in the New Mullard Master Three is the outcome of the specially designed Colvern Combined Wave Coil specified. Its high efficiency is entirely due to skilful manufacture on the one hand and efficient design on the other.

Each coil is tested before despatch in a duplicate New Master Three Receiver in order to ensure that it functions exactly in conformity with that used in the original receiver. This is your safeguard and you are advised to adhere to the author's specification.

17/6



¶ *Here we show the Colvern Combined Wave Coil in the new Mullard Master Three* as well as a view of the ingenious switch concealed in the base.*

COLVERN
ACCURATE SPACE WOUND COILS

Advertisement of Colvern Ltd., Romford, Essex.

All About the FURZEHILL FOUR

By J. H. REYNER, B.Sc., A.M.I.E.E.

THE general instructions given in last month's issue regarding this set will suffice to enable good results to be obtained, for the receiver is simple to adjust and easy to control.

One point in particular impresses those who come in contact with the set, namely, the extraordinary simplicity of the gang control. With ordinary methods the balancing operation is one which requires a fair expenditure of time and patience.

Different Settings

The setting does not hold good over the whole scale, and one has to try a number of settings, all slightly different, in order to find which gives the best results in the particular locality.

With the system of matched-reactance ganging employed in the Furzehill Four, however, this does not apply. The circuits are accurately in tune over the whole scale, so that the setting, once found, is correct for the whole wave-range.

Moreover the initial adjustment of the setting consists merely in tuning the set to some particular station with the pre-set condensers, an operation similar in every way to that of tuning a two-circuit H.F. set.

Anode Condenser

As explained in the original article, the anode pre-set condenser should be adjusted to the "nearly out" position. This gives it a capacity of about 50 micro-microfarads, and the slight additional circuit capacities increase this to 60 or 70 micro-microfarads.

The aerial condenser is then adjusted to about the mid-way point, where it has a capacity of the order of 100 micro-microfarads. This in series with the average aerial (which has a capacity of about 250 micro-microfarads) will give an effective capacity in parallel with the first coil of 70 micro-microfarads, identical with that across the anode coil.

Thus the circuits are identical as regards tuning properties, and a dual condenser may be used without any difficulty. The actual balance, of course, is obtained by trial.

The pre-set condensers are adjusted as just described. The main condenser is then rotated until a suitable distant station is heard; this station is then tuned-in accurately by small readjustments on the two pre-set condensers.

After this the receiver is balanced and no further alteration is necessary.

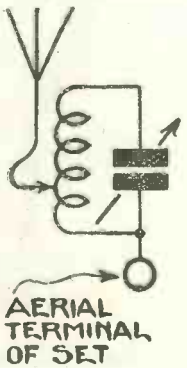
As pointed out last month, balancing should be carried out on the short-wave band.

I have been touring the country recently, and in the course of my travels I took the opportunity of testing the set in various localities. I found the results of considerable interest, for the set showed that it was suitable for use throughout the whole country and not merely in London.

A detailed test report of the results in various localities is not necessary. It will suffice to observe that the test report obtained at my laboratories can be equalled, and even exceeded, in quite remote districts, although the stations received may be somewhat different. A brief précis of the results will be of interest.

Hull.—Thirty-eight stations logged on the short-wave band and nine more on the long-wave band, during a run over the dials *lasting less than half an hour*. Several B.B.C. stations were included in this list, whereas in London the report contained principally foreign transmissions. Glasgow, Manchester, London, Cardiff, Bournemouth, Newcastle, Leeds, and Sheffield were all obtained on the loud-speaker, in addition to the local Hull transmission.

Newcastle.—Good reception here, a number of stations being obtained in a test only one mile from the Newcastle aerial. The selectivity, however, was not really good enough for the purpose and better results were obtained by using a wavetrap. See later.



Suitable wavetrap for the Furzehill Four

Perth.—Again a good test report. Swedish and Norwegian stations good here, while Dundee, Newcastle, Dublin, Bournemouth, Cardiff, London, Manchester, Glasgow, 5GB, and Aberdeen were obtained of the B.B.C. stations. Six long-wave stations were logged.

Manchester.—Conditions here seemed to suit the receiver, and a very good report was the result. As in other localities, British stations were well received—a condition of affairs which does not obtain in London and is therefore of some interest. French and Spanish stations were good here, the total report being thirty short-wave and seven long-wave stations—again obtained during a simple run over the dial of quite short duration.

The results show, therefore, that the set is suitable for all parts of the country, the only occasions where it is not completely successful being in districts very close to a local transmission.

Suitable Wavetrap

Here the use of a wavetrap can readily be resorted to and involves little extra complication. A suitable wavetrap circuit is that shown in the diagram, a series rejector trap being included in the aerial lead itself.

One final point may be noted. The screen resistance of 50,000 ohms is an average value and will adjust the screen potential in most cases to the correct value. It may be, however, that with the particular valve in use a slightly different value is desirable, and it is quite a good idea to try the effect of altering the resistance from 20,000 to 80,000 ohms to see which value gives best results. Having found the optimum resistance, of course, it should be left set.

The volume-control rheostat is cut right out for all normal reception, the resistance being inserted only for local or other strong transmissions.

EVERYTHING The G.E.C. your guarantee ELECTRICAL

Choose and get the world's programmes this Xmas

GECOPHONE

REGISTERED TRADE MARK

WORLD WIDE SCREEN-GRID 4

50 STATIONS

READ THIS REMARKABLE TESTIMONIAL,

received by a GECoPHONE dealer, from

Capt. Bentinck Budd, WORTHING.

October 7th.

With reference to the G.E.C. four-valve set I had from you last week, which I have now thoroughly tested, I would like you to know that, in my opinion, it is by far the best wireless set on the market at the present time. I have tried out many of them, as you know, since broadcasting first started. For tone, power and easiness to handle, there is nothing like it. I herewith enclose a list of Stations I can vouch for, but many more Stations have been tuned in, but I have been unable to understand the call sign, such as Stamboul, Turkey, for instance. Leningrad and Dublin I received with remarkable strength and tone. (*Signed*) H. H. BENTINCK BUDD.

PRICE including ROYALTY and Special OSRAM VALVES

£23 : 10 : 0

MADE IN ENGLAND.

Sold by all Wireless Dealers.

WRITE *for Brochure B.C. 4766, for information regarding all the season's "GECoPHONE" Radio Receivers and Gramophone Reproducers, Loud Speakers, etc., SENT POST FREE on request.*

Advt. of The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2

Used by Mr. W. James for the "TOUCHSTONE"

Columbia No. 4870 Triple Capacity H.T. Battery

£1 : 0 : 0

No matter how good a Receiver may be, its performance depends finally on the batteries.

Mr. James knew this, and when he gave the special demonstration of the "Touchstone" at Watford recently, he made *certain* by using Columb a triple capacity high tension batteries. Follow this example and equip *your* set with the world's best battery.

Columbia RADIO BATTERIES

J. R. MORRIS, Imperial House, 15 Kingsway, London, W.C.2
SCOTLAND: J. T. Cartwright, 3, Cadogan Street, Glasgow.

Dario Super H.F. means Super Radio

See page 591

ELECTROLYTIC CONDENSERS

FOR MAKING A.C. LOW TENSION UNITS.

Size: 2¼" x 2¼" x 5", 2000 mfd. Price 12/6

Made by the pioneer British makers

H. LONGTON & Co., Josephs Rd., GUILDFORD.

London Agents: MESSRS. READ & MORRIS, 31, East Castle Street, Oxford Street.

CUT THIS OUT FOR CABINETS

Our 1929 Catalogue sent you post free. Send this coupon for a copy to-day.

NAME.....

ADDRESS.....

(Write in block letters, please)

CAMCO

REGD TRADE MARK

CARRINGTON Mfg. CO., LTD.
Camco Works,
Sanderstead Road, SOUTH CROYDON
Telephone: Croydon 0623 (2 lines)

By JAY COOTE

AT times, when in the evening I have casually turned to my receiver to take pot luck of the fare the foreigners are offering to their listeners, I have wondered how I could have lived without a wireless set, yet cannot remember how in the days prior to broadcasting I filled in these odd leisure hours.

I feel sure that were I without a receiver I should not feel happy until I had bought or built one. With a multi-valve set in your possession, you need never be at a loose end; you need never moon around and rack your brains as to "what you are going to do next." The problem is solved for you; switch on the filaments and let your fingers idly twirl the condensers.

To-day, it is impossible to do so without hearing something, and there are ten chances to one that within five minutes you will have settled down comfortably to listen to a portion of the thousand and one musical broadcasts which are placed at your disposal in the course of an hour or so.

Casual Captures

It is true that at times I tune in specially to one or two stations for particular items, but I have gathered considerably more pleasure from the casual captures I have made in the ether on those days when I have set out without any definite programme in view. It is the unforeseen and unexpected which produces so much enjoyment and which, to my mind, gives to this hobby a quality possessed by but few other indoor pastimes.

Keeping a log, also, of your nightly tour in the ether will provide useful information, for by referring to it you will be reminded of "that transmission which you had just tuned in when it was on the point of closing down." Why not pay a further visit to that particular city?

If at the time you took the trouble to record the readings on the condenser dials, a slight turn of the wrist should take you there. Could anything be easier? And all this whilst comfortably seated in your armchair whilst the rain patters on the windows and the wind howls outside.

It is on such nights that I wonder how I managed to exist before the ether was filled with pleasant sounds.

◆ ◆ ◆

Use of Gramophone Records

Radio Toulouse, of all the French stations, is the one which appears to make the greatest use of gramophone records; a number of them are incorporated in every evening programme. At the same time, do not think that these transmissions are at all wearisome; they are not, for the studio has the knack of classifying them in a very judicious manner as to make for continuity of entertainment.

On two evenings weekly from this city you will also hear excellent concerts given by an orchestra of some forty musicians, and in addition, as arrangements have been completed for the 1928-29 season, on Thursdays and Sundays a relay will be made of full operatic performances from the Théâtre de la Capitole, ranking amongst the most important lyrical stages of South-eastern France. Similar to previous years, I understand that the Radiophonie du Midi has been refused the use of the telephone landlines, and will connect up with the theatre by wireless link.

As private transmitters independent of and unrecognised by the P.T.T. group, Radio Toulouse, Béziers, and Bordeaux-sud-Ouest have concluded a triangular working arrangement with a view, if at all possible, to an exchange of programmes.

I am not a subscriber to the station, but a mere distant listener; so I take it that I am not entitled to comment *in extenso* on the prolific advertisements which are nightly plugged through the mike, but I cannot help thinking that, although they may be a source of income to the Toulouse studio, this reiteration of puffs for wares sold by local dealers

(*Continued on page* 612)

STANDARD LOADING COILS

READY TO USE

As specified in P.W., A.W., M.W. SETS

WEARITE, BURNE-JONES, LEWCOS

7/6 each (latest)

SENSATIONAL OFFER IN THREE-VALVE SETS

D and 2 L.F.

RECEIVES LOCAL, 5GB, 5XX AND MANY CONTINENTAL STATIONS

Please Read Below

This is the set you are looking for. It does not require pages of flowery language to describe its virtues. It is just an honest-to-goodness set, suitable for the listener who needs quality, purity of tone, and excellent results.

WE DO NOT

CLAIM 500 STATIONS IN 20 MINUTES, but do claim that at DOUBLE THE PRICE **NO BETTER RECEIVER** is obtainable.

OUR PRICE IS

£5 : 12 : 6 Carriage forward, Case 2/-

ASSEMBLED READY TO USE in handsome American type oak polished cabinet. HINGED LID. All components enclosed.

RECEIVER AS SHOWN	LOUD-SPEAKER (Cone 12/6 extra)
3 British Valves (1 Power. Dull Emitter)	100-volt H.T. BATTERY
NO COILS TO CHANGE	2-volt L.T. BATTERY
AERIAL EQUIPMENT, GRID BIAS	LEADS

NOTHING ELSE TO BUY

Only obtainable at K. Raymond's

ANY MAKE OF SPEAKER CAN BE SUPPLIED BY ARRANGEMENT

THE SQUIRE ALUMINIUM CRADLE FRAME AND CONE KIT FOR VARIOUS UNITS (Balanced Armature)

CONE KIT comprising KRAFT DIAPHRAGM, CARD RING and SEGMENTS (Post 3d.) **2/6**

Aluminium CRADLE FRAME; ready to use **12/6**

Complete Lot .. **15/-** (Plywood Clamping Washer Free)

VALVES

MULLARD D., H.T., L.F., 10s. 6d.
Power, 12s. 6d. Super Power, 15s.
2 v. 4 v. 6 v.
Screened Grid upright, 22s. 6d.
Pentode (Pentone) 25s. 2 v. and 4 v.
COSSOR, MARCONI, OSRAM, B.T.H., EDISWAN, SIX-SIXTY
2 v. 4 v. 6 v.

OUR NEW CATALOGUE

incorporates latest valve data, profusely illustrated, 143 pages, 1s., which is allowed off first 10s. order.

The ORIGINAL MULLARD MASTER 3

Many customers still wish to build, so we repeat offer

No solder—only 20 wires to connect. COMPLETE SET OF COMPONENTS. 2 Term. strips 2½ x 2, Lewcos Base, 2 1.B. condensers, Climax H.F. choke, 3 Valve Holders, Magnum Brackets, 4 Terminals, Spade Terminals, Wander Plugs, Bulgin Switch, R.I. Unit, R.I. L.F. Transformer, Mullard .0003, 2 meg. Leak, Flex, Screws, &c.
And Three Mullard P.M. Valves

£5 : 17 : 6 Total

FOR **5s.** EXTRA YOU CAN BUY (with Parts only)

Aluminium Panel 18x7 drilled. Highest possible quality. Grid Bias 9 v. 2 wound Coils, long wave and B.B.C., for Master 3. Set of Links for connecting Baseboard. Carriage 1/3 (extra over 150 miles.)

Magnificent Oak or Mahogany American Type Cabinet value 25/- for **16/11** with above parts (only).

Be Sure it's RAYMOND'S

BRITAIN'S "FAVOURITE 2"

ALL PARTS STOCKED

Ebonite Panel, .0005 Ormond S.L.F., S.M. Dial, 6-ohms, 2-way geared with 4 Terminals, long handle, 2 Lotus Valve Holders, .0003 and Series Clip, 2 meg. Leak, B.T.H. or R.I. and Varley L.F. Transformer, .0005 Fixed, Strip 4 x 2, 8 marked Terminals, G.B. Clips, 2 Wander Plugs, Square Wire.

The Lot 45/- Nett.

BRITAIN'S "FAVOURITE 3"

LIST OF COMPONENTS

Ormond .0005 and .00025 Log Mid-line Condensers, 7-ohm Panel Rheostat, 3 B.R. Valve Holders, 2 Single Coil-holders, .0003 Fixed and Series Clip and Dubiller 2-meg. Leak, H.F. Choke, R.C. Dubilier Unit, R.I. Transformer, 7 marked Terminals, 2 Strips 4 x 2.

Latest Nett. Price - 57/6

KITS of PARTS FOR ALL CIRCUITS

Send Detailed List for Keen Quotations

ORDER EARLY FOR QUICK DELIVERY

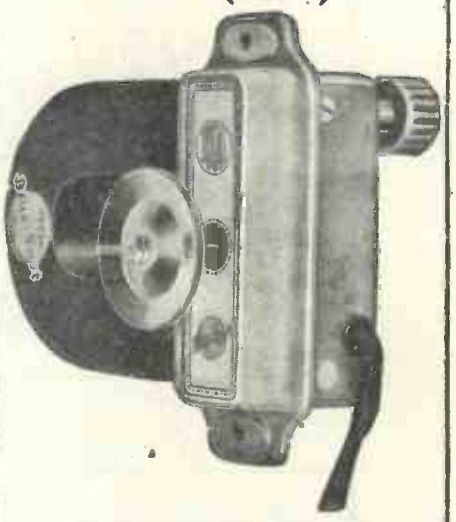
K. RAYMOND

27 & 28a LISLE ST., LONDON, W.C.2

Come to LEICESTER SQUARE TUBE

This address is at the back of Daly's Theatre. Phones: Gerrard 4637 and 2821

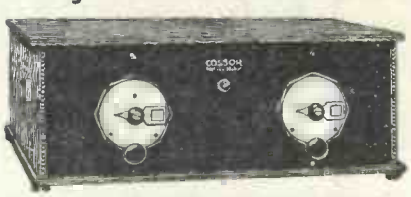
BLUE SPOT 66K (101)



ADJUSTABLE MODEL
4-POLE BALANCED ARMATURE

Order 25/- Early

The Original COSSOR MELODY MAKER



Still remains the "SET OF THE SEASON."
THESE ARE THE SPECIFIED PARTS.

Special Price £3:19:6

(Packing and Carr. 1/6, U.K. only).

2 Ormond .0005	3 Dubilier Leaks
2 S.M. Dials	3 Lotus Valve Holders
6 T.C.C. Condensers	Ferranti A.F.3
2 B.B. Clips	2 Switches
1 B.B. Rheostat	9 named Terminals

And splendid PIRITE FORMER wound with double Silk Wire to specification (with improved reaction, 3/6 extra).

FOR **2/6** EXTRA — YOU CAN BUY WITH ABOVE KIT →
21x7 Polished Panel
21x1½ Strip
9-volt Grid Bias
20 ft. Connecting Wire
Screws

OAK or MAHOGANY (21x7) AMERICAN TYPE CABINETS AS SHOWN, HINGED LID and Baseboard

21/- Magnificent Quality — But will be included with parts for 16/11 if purchased same time

DARIO RADIO MICRO VALVES

2 VOLT	General Purpose .05 amp.	5/6
	R.C.C. .06 amp.	5/6
	Super-Power. .18 amps.	7/6
4 VOLT	General Purpose .05 amp.	5/6
	R.C.C. .07 amp.	5/6
	Super-Power. .1 amp.	7/6

WEILO L.F. TRANSFORMERS

8/6 and 11/6

TRY ONE!

Continental Notes (Continued from page 608)

must annoy the man who wants to enjoy a musical programme.

If you listen to Radio Toulouse, you will hear, say, an excellent duet from a popular opera sung by some of the world's best artists—a first-class record—then, as almost the last note is still ringing in your loud-speaker, you will be disturbed by the bell, which has replaced the metronome. No longer does the announcer repeat his "Allo ! Allo ! Radio Toulou-se" after each item; there is no need. The one-pong-p.r-second bell tells you to what station you are tuned in.

But, apart from the signal, the charm of the previous broadcast will be broken by a long discourse on the qualities of an infinite variety of goods, ranging from children's hole-proof socks to wonderful high-tension batteries which, although generous in feed, would appear to outlive their owners !

Spoiling Good Programmes

It is by these publicity insertions in the course of the entertainment that Radio Toulouse spoils what could otherwise be deemed interesting programmes. My reference to microphone publicity leads me to refer to Madrid (EAJ7), from which, on any evening in the course of a concert or between the acts of a dramatic performance, you will pick up a dialogue between two men, one of whom, if we are to judge by the repeated explanations given to him by his colleague, acts the part of the pantaloon in a pantomime.

Apparently, here again we encounter a new method of drawing the attention of the Spanish listener to somewhat flagrant advertisements, and the patter of these cross-talk comedians recurs at frequent intervals during the evening.

From the German Stations

Broadcast publicity may also be found at most of the German stations, but it is usually relegated to the end of the main programme and tacked on to the news bulletin, a method frequently adopted by Radio Belgique. Generally speaking, although a number of continental stations use the microphone for this purpose they do not allow the advertisements to mar the continuity of their entertainments.

◆ ◆ ◆

Of late I have made a regular habit of turning to Stuttgart at least twice in the course of every evening; of all the German broadcasters it is the one which provides the most unexpected stunts, and on many occasions, departing from its published programme, it may afford you pleasant surprises.

It was from Stuttgart in the first instance that I picked up an American commentary on the passing of the Graf Zeppelin over New York on its way to Lakehurst, and it was again from this station that I received the first news of the arrival of the airship at its destination.

On the next afternoon, as luck would have it, I turned to the same dial settings, and picked up the speeches of Commander Eckener and others, relayed from Friedrichshafen. As a stunt, Stuttgart also broadcast

(Continued on next page)

Continental Notes

(*continued from page 612*)

a greeting in English by Clarence Terhune, the stowaway "caddie."

Stuttgart works hand in hand with Frankfurt, with which city it exchanges numerous programmes. From either of these transmitters you may receive the best of what these two important centres have to offer. Bear in mind, however, that from the former you will not get the call embodying its name; the announcement is often merely "*Hier Suedfunk*," which covers both Stuttgart and Freiburg.

A Standard Feature

It is the German station *par excellence* for relays of U.S.A. programmes, of which during the winter months it makes a standing feature. Its short-wave pick-up installation is housed in the top story of the Schloss Solitude ("The Lonely Castle"), situated on a high hill in the neighbourhood of the city.

Every facility has been granted to the engineers and landlines connecting this peculiarly favourable position have been run to the Stuttgart switchboard, which in its turn, as part of the Reichsfunk broadcasting net, permits a simultaneous broadcast, when necessary, from the other German stations included in the organisation.

Advantage to Listeners

The fact that Stuttgart and Frankfurt work together on special nights constitutes an advantage to the distant listener; they are both powerful transmitters, and if the former, through interference, is difficult to hold you always possess another string to your bow.

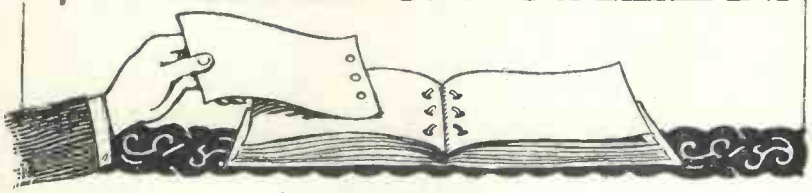
◆ ◆ ◆

By the time these lines are in print, Radio Belgique should have brought into operation its new high-power broadcaster. From time to time, on those evenings when it was being tested, you will have noticed how much stronger have been the signals received from Brussels.

Although, unfortunately, in a position of the waveband which is oft marred by morse, notwithstanding

(*Continued on page* 616)

"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. 101***

Wire, Current Carrying Capacity of

IT is often useful to know the current which can be safely handled by a given size of wire. In order to calculate the safe carrying current, a current density of 1,000 amperes per square inch is often chosen, but this has been found to be on the low side, and provided adequate cooling facilities are present, a greater current than this may be chosen.

The Institution of Electrical Engineers has given safe carrying currents for wires down to No. 22 S.W.G., these figures being based on a formula which takes into account the surface of the wire, since the greater the surface the greater the radiation and consequently the greater the permissible heating. Thus the finer the wire, the smaller the current density which can be permitted, and for ordinary gauges in wireless practice this lies between 3,000 and 4,000 amperes per square inch.

The figures in the following table give the permissible currents for various gauges on the rating of 1,000 amperes per square inch and on the more practical I.E.E. rating. The latter figures have been extended beyond No. 22 S.W.G. on the assumption of a current density of 4,000 amperes per square inch. These extended figures are in italics :—

S.W.G.	*Safe Current (1,000 amps. per sq. in.)*	*I.E.E.*
18	1.81	*7.2*
20	1.02	*4.0*
22	0.62	*2.5*
24	0.38	*1.5*
26	0.25	*1.0*
28	0.17	*0.68*
30	0.12	*0.48*
32	0.092	*0.37*
34	0.066	*0.26*
36	0.045	*0.18*
38	0.028	*0.11*
40	0.018	*0.072*

WIRELESS MAGAZINE Reference Sheet ***No. 102***

Fusing Currents

IT is often useful to know the current which any wire will carry as a fuse, and also the current at which the same wire will burn out and so blow the fuse. The maximum current which a wire will safely carry as a fuse is quite different from the safe carrying capacity when used in the winding of a portion of some apparatus. These normal safe values were given in Sheet No. 101.

The figures given in the table below show the safe and fusing currents for various kinds of wire. Ordinary copper wire can be used as fuse wire, provided the correct size is chosen, and it will be seen from the figures that the safe carrying capacity of copper fuses is approximately half the actual fusing current.

The ordinary fuse wire is usually made up of a lead-tin alloy, which has the advantage that it will fuse with only 50 per cent. increase in current above the safe value. It thus affords a greater protection to the circuit. The figures for the customary alloy are given in the table below.

It should be remembered that the figures are approximate, the actual current being dependent to some extent on the length of wire, method of mounting, etc. The variation is not large, however.

FUSING CURRENTS IN FREE AIR (AMPERES)

S.W.G.	COPPER		LEAD TIN ALLOY	
	Safe Current	*Fusing Current*	*Safe Current*	*Fusing Current*
16	78	156	11	16
18	49	98	7	10
20	31	62	4.8	7
22	21	42	3.3	5
24	15	30	2.3	3.5
26	11	22	1.8	2.8
28	8.5	17	—	—
30	6.8	13.5	—	—
32	5.5	11	—	—
34	4.3	8.6	—	—

WIRELESS MAGAZINE Reference Sheet — *No. 103*

Short-wave Chokes

IN view of the existing use of ultra-short waves for long-distance work, it is becoming the practice to design receivers capable of reception on all wavelengths from 2,000 metres downwards. One of the problems which arises in such designs is that of the effective blocking of high-frequency currents from those portions of the receiver where their presence is undesirable.

On the normal broadcast band, a high-frequency choke is employed for this purpose, and it has become the practice to insert special short-wave chokes in series with the normal high-frequency choke in an endeavour to improve the effectiveness of the arrangement. In some quarters it has been suggested that this is a useless system, since the two chokes merely tend to act as one.

This is not so if the short-wave choke is correctly designed. An ordinary H.F. choke, on these very short wavelengths, merely acts as a small self-capacity, and the smaller the actual value of self-capacity the more effective the choke. Thus a really well-designed H.F. choke will have a very small value of self-capacity, rendering it an efficient barrier on very short waves, while at the same time it will have a high inductance, which makes it satisfactory up to wavelengths of 2,000 metres or over.

A short-wave choke is one having a relatively small number of turns, the object being to keep the self-capacity down to the lowest possible limit. The inductance of the choke is made such that its resonant point, in circuit, occurs above the normal working range. Such a choke is thus quite satisfactory for use in a short-wave receiver, but if the set is to be extended in its operation to broadcast waves, then a high-frequency choke of the ordinary type must be included in series.

Tests at the Furzehill Laboratories have shown that provided the short-wave choke is definitely more efficient on the ultra-short waves than the H.F. choke itself, then there is a distinct advantage in placing the two in series, the combined effect being more efficient than either of the chokes individually. If, on the other hand, the short-wave choke is less efficient than the standard H.F. choke with which it is placed in series, then there is no advantage whatever, the combined choking effect being exactly the same as that of the standard H.F. choke itself.

There are relatively few short-wave chokes on the market which are really efficient, when viewed in this light, for use with a good H.F. choke.

WIRELESS MAGAZINE Reference Sheet — *No. 104*

Specific Gravity

THE electrolyte or liquid in an ordinary accumulator is dilute sulphuric acid of a certain consistency. The proporton of acid to water varies in accordance with the state of charge. When the cell discharges, the lead oxide on the positive plate becomes converted into lead sulphate, and water is liberated so that the acid solution becomes weak. When the accumulator is charged, this operation is reversed and acid is liberated so that the solution becomes stronger.

The state of a battery may therefore be gauged by measuring the strength of the solution, which is done in terms of the specific gravity. The specific gravity of water is unity, while the specific gravity of pure sulphuric acid is 1.84.

Actually a solution of about 30 per cent. acid is employed for normal use in accumulators, the specific gravity of a fully charged cell lying between 1.210 and 1.220: as the cell is discharged this specific gravity falls to 1.159 or 1.200, depending upon the state of discharge.

For portable accumulators and small wireless cells where the amount of electrolyte is limited, the change in specific gravity is greater than in large stationary cells, and in a batch of large cells, such as are used for house lighting, the gravity does not fall below 1.180 or thereabouts.

For wireless purposes, the specific gravity figures are usually quoted by the makers of the cells themselves, but the table below will indicate the approximate order of specific gravity which obtains in practice:—

Cell fully charged and gassing freely	1.250–1.280
Normal position, fully charged	1.210–1.220
Cell discharged, requires recharging	1.150–1.200
Cell badly discharged and in danger of sulphating	1.100

If the gravity is allowed to fall and remain much below 1.150, the lead sulphate formed is of an insoluble variety and continues to form whether the cell is in use or not. This ruins the cell.

WIRELESS MAGAZINE Reference Sheet — *No. 105*

Push-pull Amplification

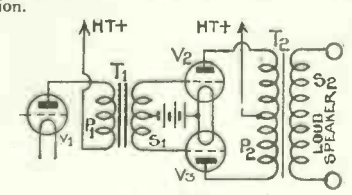
PUSH-PULL amplification is used extensively in cases where a large power output is required without the use of special valves. It is generally employed in the final stage only of a low-frequency amplifier.

In the diagram is shown the circuit of a push-pull amplifier preceding the loud-speaker. Current variations on the plate of V1 produce voltage fluctuations across the primary P1 of the transformer T1. The ends of the secondary winding are connected to the grids of the valves V2 and V3, whilst the centre point of this winding goes through the grid-bias battery to L.T. negative.

If we suppose that there is a positive potential applied to the grid of the valve V2, there will be a negative potential on the grid of the valve V3. These potentials will cause current variations on the plates of V2 and V3, resulting in opposite potentials at either end of the primary of the transformer T2, across the secondary of which the loud-speaker is placed.

Since use is made of the potentials at either end of P1, instead of only at the grid end, it follows that V2 and V3 are doing double the work of a single valve, assuming that these valves all have the same characteristics. It is now simple to understand the derivation of the word "push-pull" as applied to this form of amplification.

There is a further advantage gained by the use of "push-pull" amplification for large power outputs, in that the primary P2 of the output transformer T2 has a centre tapping which is taken to H.T. positive. Heavy currents flowing from H.T. positive to the plates of the valves V2 and V3 flow in opposite directions along the primary, and, in consequence, the magnetisation effect of the iron core cancels out, thus preventing the possibility of saturation.



Push-pull Circuit

Continental Notes

(*Continued from page 613*)

its increased energy, Radio Belgique can be kept separate from the Vienna (Rosenhuegel) transmissions. If the broadcasts do not heterodyne it is, believe me, due to the fact that both these stations conscientiously maintain their exact frequencies.

Nothing less than this can be expected of Brussels, seeing that it is in that city that most of the measurements of other transmitters are carried out.

Alternative Entertainment

The Belgian capital for some little time past has enjoyed an alternative wireless entertainment, inasmuch as, although but a small competitor, Radio Schaerbeek, a privately owned studio, has displayed considerable ingenuity and initiative in securing for its listeners relays from some of the best cabarets and night haunts of Brussels.

Up to the present, the range of the transmitter has been but a small one; but with the promise that in the near future its energy is to be increased to some 3 kilowatts, there is no reason for which, at a late hour, we should not shortly visit, through its intermediary, two of the most popular night resorts of the pleasure-going "Brusseleers," namely, the Merry Grill and the Moulin Rouge, the latter, an attempt to revive in the Belgian capital the fame of the historic Paris music-hall.

THE NAME "TOUCHSTONE"

READERS who saw what the Editor had to say in the November issue on the derivation of the word TOUCHSTONE will be surprised to know that there has been in some quarters confusion between this word and a trade-mark belonging to Messrs. Gent & Co., of Leicester, which firm, we now learn, owns the registered trade-mark TOUCHTONE. Note the absence of the "s." We hope that Messrs. Gent & Co. have not been caused any inconvenience by our use of a word which in its derivation is entirely different from theirs, although in pronouncing the two words it is difficult to distinguish one from the other.

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Each blueprint shows the position of each component and every wire and makes construction a simple matter. Copies of the "Wireless Magazine" and of "Amateur Wireless" containing descriptions of all these sets can be obtained at 1s. 3d. and 4d. respectively, post free.

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All these 6d. each, post free.

Two-programme Set	WM25
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Tapped-coil Set	AW 95
"Best-yet" Set	AW114

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Economy One	AW 71
Loud-speaker Special	AW 78
Ultra-sensitive Hartley One	AW103
Fan's Short-wave One	AW119
Super Reinartz One	AW127
Beginners' One-valver	AW140

TWO-VALVE SETS

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Two-programme 2 (D, Trans)	WM56
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Key-to-the-Ether Two (D, Pentode)	WM107
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★Wide-world Short-waver (SG, D, Trans.)	WM120
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Reinartz 2 (D, Trans)	AW 21
Empire Short-wave	AW 28
Next Step 2 (D, Trans)	AW 34
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Gramophone Three (D, 2RC)	W M115
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★Standard Coil Three (HF, D, Trans.)	WM117
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SEVEN-VALVE SETS

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Table Grand 4 (HF, D, 2RC)	AW 93	1/6	
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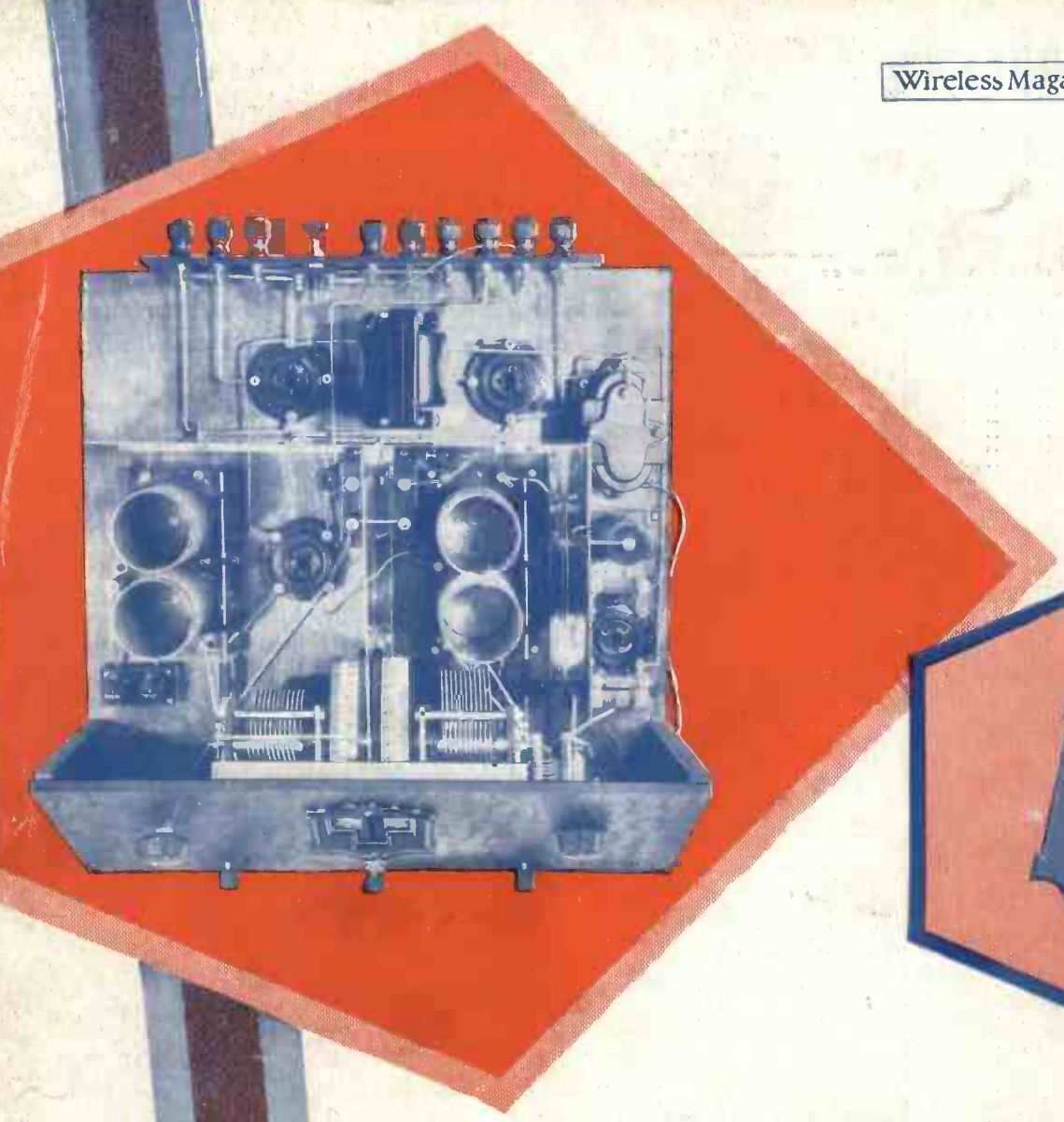

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