

Wireless

VOL. I.
MARCH

NO. 4
1935

AND TELEVISION REVIEW

PRICE

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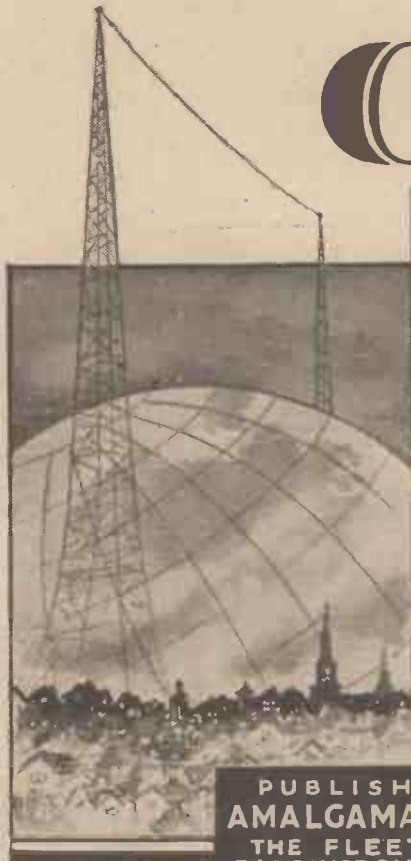
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CONTENTS



	Page		Page
The Editor's Chat	143	From My Armchair	167
The "One-Point-Five"	144	Practical Hints for All	168
Short Wave Notes	154	Questions I Am Asked	170
B.B.C. News	159	Wireless in the Great War	171
"A Storehouse of Radio Knowledge"	160	Simple Short-Wave Reception	174
New Apparatus Tested	161	Using Your L.F. Valves	175
New Distinction for Valve Pioneer	162	The Big Three	178
Making a "Hit"	162	Listen to These	178
Notes on Television	163	Harnessing the Electron	180
New B.B.C. Director Wanted?	166	The B.B.C. Gets Ready for Television	182
		An All-Wave All-Mains Circuit	187

SPECIAL COMMERCIAL SET SECTION

The "Wireless" Listeners' Circle 155-158

As some of the arrangements and specialties described in this Journal may be the subjects of Letters Patent the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

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Wireless

& TELEVISION REVIEW

A New S.T. Receiver—The Television Committee's Report—Dr. J. H. T. Roberts' Evidence

CONSTRUCTORS will welcome the details which we are publishing in this issue for building Mr. John Scott-Taggart's magnificent new receiver, the "One-Point-Five." As our distinguished contributor points out, the "One-Point-Five" is a complete set on its own, and has been designed from start to finish as a complete set. Nevertheless, it will be of interest to a great many of our readers, who have built the S.T.400, to note with what ease the conversion from that receiver to the "One-Point-Five" may be carried out. And it will further interest our readers to know that many of the outstanding features of the S.T.600—which was fully described by Mr. Scott-Taggart in our sister journal "Popular Wireless"—are incorporated in the "One-Point-Five."

An Easy Conversion

In fact, the name of the set was decided upon because of its ease of conversion from the S.T.400—and if you divide 400 into 600 you will see that the answer is the title of Mr. Scott-Taggart's new set.

Incidentally, Mr. Scott-Taggart points out that as regards performance of the S.T.400 and the "One-Point-Five," he has not the slightest hesitation in saying that the performance of the "One-Point-Five" is almost miraculously better than the S.T.400.

* * *

The long-awaited report of the Television Committee is now on sale at His Majesty's Stationery Office, price 6d. The report is extremely interesting and

very encouraging. The principal conclusions and recommendations of the Committee are that no low-definition system of Television should be adopted for a regular public service.

Under B.B.C. Control

The Committee considers that high-definition Television has reached a standard of development which justifies first steps being taken towards the early establishment of a public Television service, and that the B.B.C. should be entrusted with the operation of such a service.

The Committee recommends that the Postmaster-General should forthwith appoint an Advisory Committee to plan and guide the initiation and early development of a Television

comprehensive Television patent pool should eventually be formed. The Committee recommends that a start should be made by the establishment of a service in London with two Television systems operating alternately from one transmitting station and that Baird Television Limited and Marconi-E.M.I. Television Co., Ltd., should be given an opportunity to supply—subject to conditions—the necessary apparatus for the operation of their respective systems at the London station.

Additional Stations

In the light of experience obtained with the first station, the Advisory Committee should proceed with the planning of additional stations—until a network of stations is gradually built up. The Committee estimates that the cost of providing and maintaining the London station up to the end of 1936—when the B.B.C. charter expires—will be about £180,000. Revenue should not be raised by the sale of transmitter time for direct advertisements, but the permission given in the B.B.C.'s existing licence to accept certain types of sponsored programmes should be applied also to the Television service.

Revenue should not be raised by an increase in the 10s. fee for the listener's licence, and there should not be any separate licence for Television at the start of the service, although the question should be reviewed later in the light of experience.

The cost of Television service, (Please turn to page 186.)

THE WAVELENGTH SHUFFLE

Don't forget that from Feb. 17th, several of the British broadcasters are rearranging their wavelengths, in accordance with the following table:

	OLD Metres.	NEW Metres.
North National	296.2	261.1
Midland	391.1	296.2
Scottish	373.1	391.1
West	307.1	373.1
Belfast	267.4	307.1
Newcastle	209.9	267.4

Droitwich, the new high-power long waver of course is not affected and foreign stations will retain their present wavelengths.

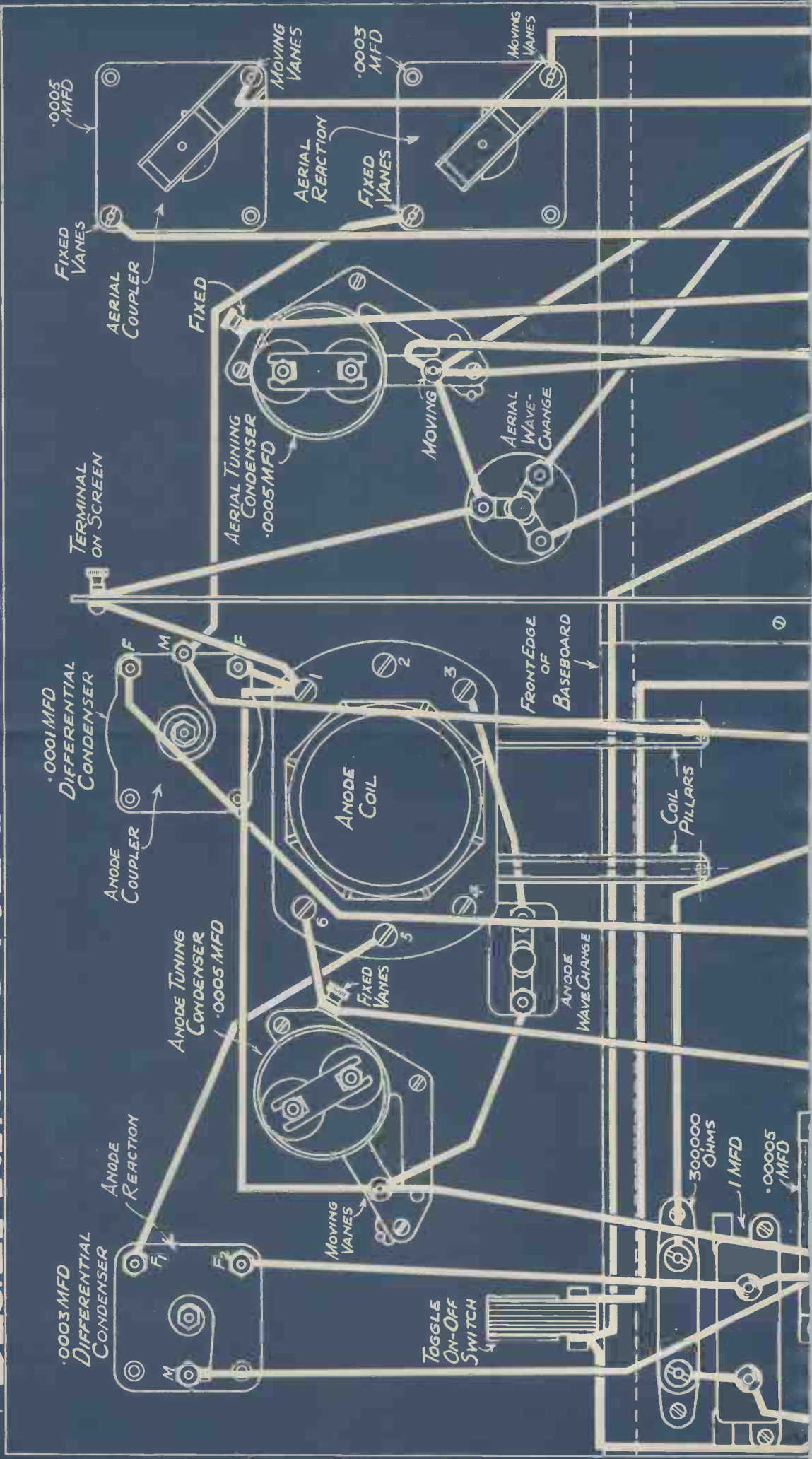
service. Ultra-short waves are recommended—the transmitting stations to be situated at elevated points with masts as high as practicable.

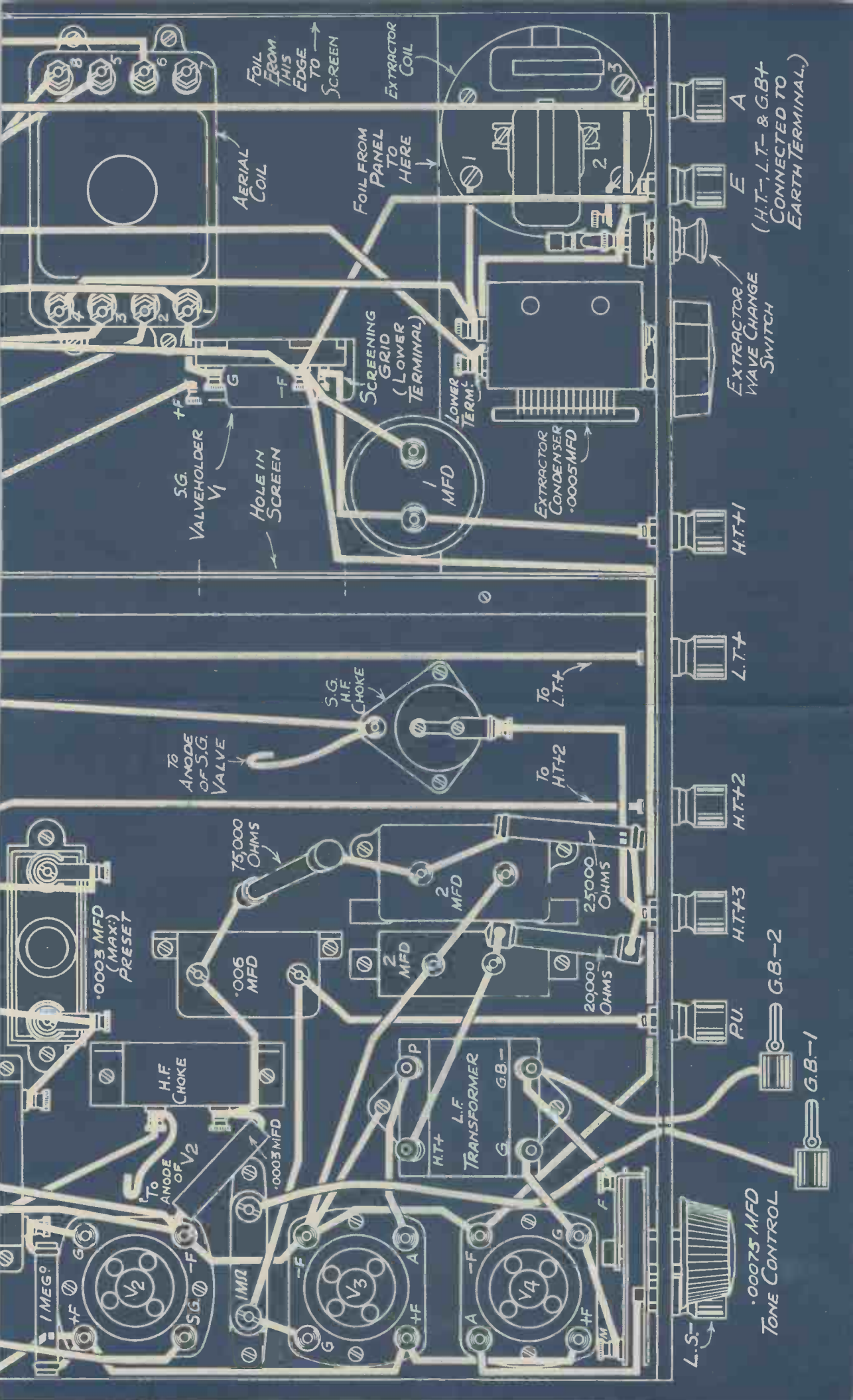
It is considered that at least 50 per cent. of the population could be served by ten ultra-short wave transmitting stations in suitable locations.

It is, therefore, recommended as desirable in the general interests that a

1/2-FULL SIZE BLUEPRINT "ONE-POINT-FIVE" WIRELESS. MARCH 1935

DESIGNED BY JOHN SCOTT-TAGGART





FOIL FROM THIS EDGE TO SCREEN

EXTRACTOR COIL

AERIAL COIL

FOIL FROM PANEL TO HERE

SCREENING GRID (LOWER TERMINAL)

LOWER TERM.

EXTRACTOR CONDENSER .0005 MFD

S.G. VALVEHOLDER V1

HOLE IN SCREEN

1 MFD

EXTRACTOR WAVE CHANGE SWITCH

(H.T., L.T. & G.B+ CONNECTED TO EARTH TERMINAL.)

To ANODE OF S.G. VALVE

S.G. H.F. CHOKE

To HT+2

To L.T.+

.0003 MFD (MAX) PRESET

75000 OHMS

.0006 MFD

2 MFD

25000 OHMS

20000 OHMS

H.F. CHOKE

To ANODE OF V2

.0003 MFD

L.F. TRANSFORMER

G.B.-

G.B.-2

G.B.-1

.00075 MFD TONE CONTROL

L.S.-

HT+1

L.T.+

HT+2

HT+3

P.U.

A

E



cerned, two years represent the active life of one of my principle designs, although I think it highly likely that there are many S.T.300's still in use, in spite of this set being now three years old.

What, then, have I been doing during the last two years? I suppose that the best way of answering this is to say that I have been trying

to sacrifice a little in other directions the S.T.500 still stands, and will probably continue to stand, for at least another year on its own merits.

It has been found, however, that the average reader seems to incline towards a higher standard of performance on a large number of foreign stations rather than a louder volume on fewer stations, and that the output from a so-called super-power valve is adequate for most people.

To beat the S.T.400 as regards selectivity and sensitivity was no easy task. Nevertheless, I was determined not to offer any receiver which was not "streets ahead"—to use a popular phrase—of the S.T.400.

The ultimate receiver was the S.T.600 described in "Popular Wireless"

How TO BUILD

“One-Point-Five”

THE S.T.400 receiver, which I described on November 15th, 1932, is now nearly 2½ years old and, although it is giving very good service in all parts of the country, progress in receiver design is such that a set of this kind must almost inevitably become obsolescent after such a period.

Note I use the word obsolescent instead of obsolete. It has always been my policy to design sets which can face bravely and confidently any worsening of ether conditions. How far I have been successful in achieving my aim is for the public to decide. There are sufficient S.T. sets, and the period of their use has now been long enough, for a fair estimate to be made.

Better Components

Nevertheless, improvement is always possible, and I should regard it as a very strange state of affairs if in two years I could not improve on a previous design!

Within that period, quite apart from circuitual research, there are improvements in components and in valves. Particularly in this latter respect are we dependent upon the work of others, since for a set designer to influence valve manufacture is very difficult unless such a designer is willing to purchase tens of thousands of the valves.

As far as my own activities are con-

cerned, two years represent the active life of one of my principle designs, although I think it highly likely that there are many S.T.300's still in use, in spite of this set being now three years old.

What, then, have I been doing during the last two years? I suppose that the best way of answering this is to say that I have been trying to improve on the S.T.400 and to be in a position to offer something considerably better at the expiration of the two years.

The "One-Point-Five" is a complete receiver of its own, and is designed from beginning to end as a complete receiver, but at the same time it is of special interest to S.T.400 owners because of the ease with which a conversion may be carried out.

Many of the outstanding features of the S.T.600—described by Mr. Scott-Taggart in our sister journal, "Popular Wireless"—are incorporated in the "One-Point-Five," and it is thus that it obtains its name: by dividing 400 into 600.

cerned, two years represent the active life of one of my principle designs, although I think it highly likely that there are many S.T.300's still in use, in spite of this set being now three years old.

dated October 27th. This set involved so many departures, both technical and practical, from the S.T.400 design, and therefore from the components, that a great deal of disappointment resulted in the ranks of S.T.400 users. As the S.T.400 was a development of the S.T.300, many of the parts could be used for the larger set, and many constructors, in spite of my warning, rather felt that this process could go on indefinitely.

Extraordinarily Successful

There are several reasons why it is not possible to improve sets simply by adding bits. Sooner or later you have to branch out in another direction. However, the S.T.600 has proved such an extraordinarily successful receiver in the hands of the public, and has been by far the most popular set this season, that I determined to "explore" every technical "avenue," to see how far the technical principles of this exceedingly successful set

could be adapted to the S.T.400. The result is the "One-Point-Five." This name has been chosen because the set I am about to describe is really "400 into 600." The result of such a "problem" is 1½ or 1.5 (one point five). I am not a believer in hybrids, and although a number of S.T.400 constructors wrote asking me to explain how the S.T.400 could be converted to S.T.600, I said that I could not undertake to give such advice. I knew perfectly well that you cannot take a bit of one set and lightly add it to another. A considerable amount of design work and experiment is always necessary, and experience has taught me that there are very few things you can advise a constructor to do unless you have actually tried them out yourself.

A Complete Receiver

This "One-Point-Five" receiver, which I am describing in this issue of WIRELESS, is a complete receiver of its own, designed from beginning to end as a complete receiver. It is not a hotch-potch, but a genuinely new set. It has had just as much care and thought given to it as the S.T.600 but, on the other hand, it is no better than the S.T.600. In fact, it lacks some of

FULL DETAILS OF A MARVELLOUSLY SENSITIVE RECEIVER CONCEIVED BY BRITAIN'S GREATEST RADIO DESIGNER

two tuning dials will not scare him. Actually, as regards operation, the "One-Point-Five" is simpler and more straightforward than the S.T.400, partly because the aerial coupler does not affect the tuning of the left-hand tuning dial, and secondly, because the aerial reaction which is used on this set is better to work and considerably more effective than on the S.T.400.

There is a third reason for the simplicity, but it is a more general one. It is this: the great ease with which the local station can be cut out makes for much greater simplicity in tuning, since one is only concerned in receiving the foreign stations without having to bother about cutting out the local one. Moreover, the greatly improved sensitivity of the set also contributes to the ease of tuning, and makes it less necessary to extract the last ounce out of the circuit.

But my technical readers will be

far more interested in the actual performance than the question of simplicity of tuning. How does this new set compare with the S.T.600 on the one hand, and the S.T.400 on the other? Well, as regards the S.T.600, I should say that there is little to choose between the two sets. The "One-Point-Five" possesses the advantage that its two circuits are tuned by separate condensers; on the other hand, the S.T.600 has a front concentric trimmer, and unless there is faulty ganging or bad matching there are no disadvantages in having one-knob

"As regards comparing the S.T.400 and the 'One-Point-Five,' I have not the slightest hesitation in saying that the performance of the 'One-Point-Five' is almost miraculously better than the S.T.400."
J. S.-T.

tuning. On the other hand, the "One-Point-Five" is always certain to be exactly in tune. Another point is that the use of the differential anode coupler enables the set to be worked with rather tighter coupling on the anode circuit of the S.G. valve, and this may give slightly stronger signals. In those cases where selectivity is not essential, e.g. during daylight.

Very Definite Improvement

The fact that an S.G. valve is used instead of an H.F. pentode, as in the S.T.600, is not a cause for worry. The H.F. pentode is in many cases no improvement, as regards sensitivity, over a good S.G. valve, and although it is necessary in the S.T.600, I am perfectly content that S.T.400 users should use the S.G. valve they are now employing, provided, of course, it is one of those originally recommended

Designed & Described
by
JOHN SCOTT-TAGGART
M.I.E.E., F.Inst.P., Fel. I.R.E.

the merits of the later receiver. Since there is no one knob tuning as in the S.T.600, you will miss the full ease of tuning which is one of the delights of the S.T.600. You will also not be able to use the "spot-on" dial which I have developed for that set.

The S.T.400 user is, however, not a simplicity fan, and the operation of



for the S.T.400, and is not the earlier type of S.G. valve used in the S.T.300.

As regards selectivity, the "One-Point-Five" and the S.T.600 are exactly alike, and the same applies to quality of reproduction.

The builder of the "One-Point-Five" can therefore rely on obtaining similar technical performance as the S.T.600.

Although the cost of converting the S.T.400 to the "One-Point-Five"

THE POWER SUPPLY

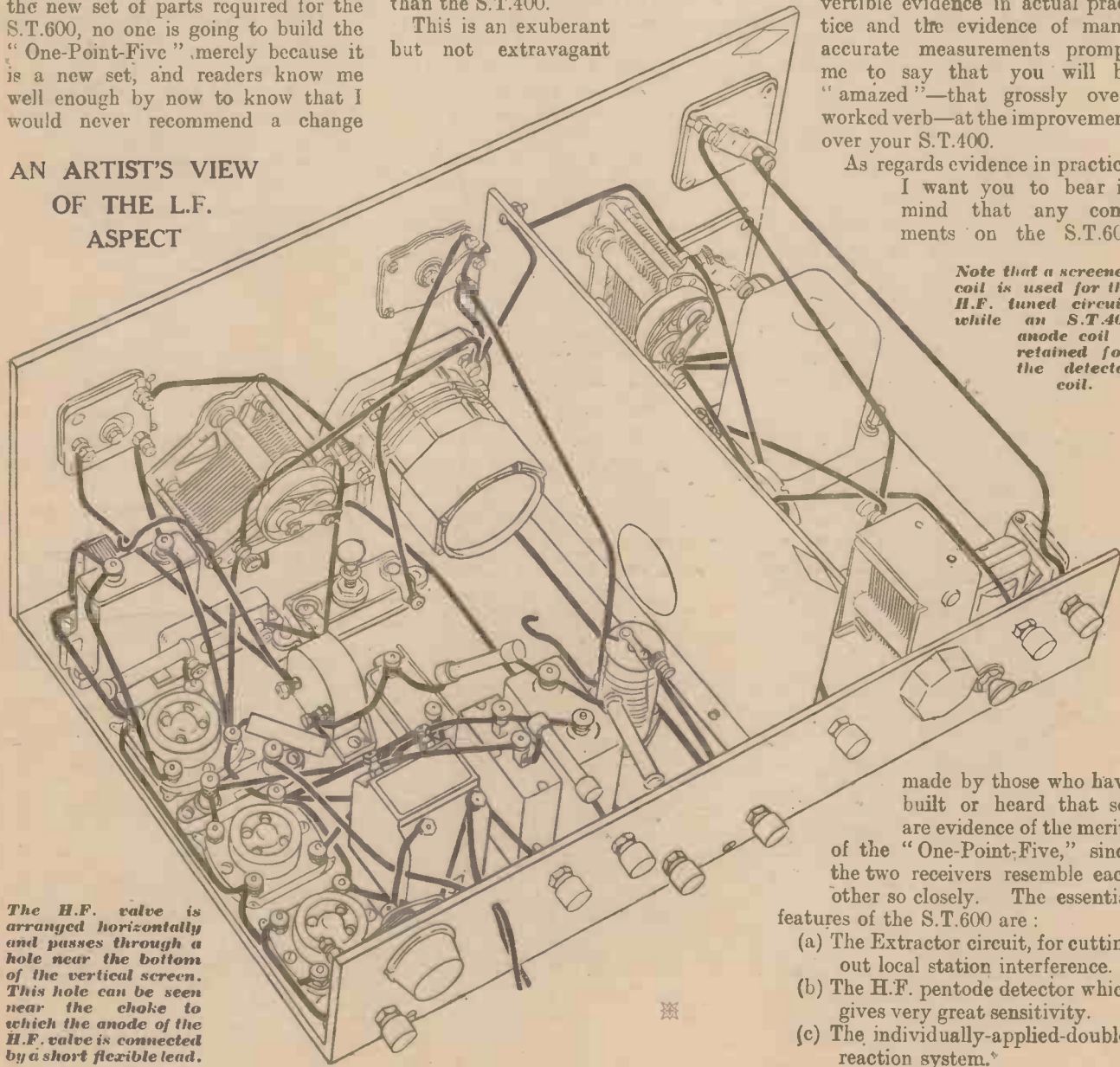
BATTERIES—H.T.: G.E.C., Drydex, Ever Ready, Lissen, Siemens, Vidor, or Block H.T. Accumulators.

G.B.: Drydex, Ever Ready, Lissen, Siemens.

L.T.: Exide, Block, Lissen.

is very much smaller than the cost of the new set of parts required for the S.T.600, no one is going to build the "One-Point-Five" merely because it is a new set, and readers know me well enough by now to know that I would never recommend a change

AN ARTIST'S VIEW OF THE L.F. ASPECT



The H.F. valve is arranged horizontally and passes through a hole near the bottom of the vertical screen. This hole can be seen near the choke to which the anode of the H.F. valve is connected by a short flexible lead.

unless a very definite improvement in one direction or another could be obtained.

As regards comparing the S.T.400 and the "One-Point-Five," I have not the slightest hesitation in saying that the performance of the "One-Point-Five" is almost miraculously better than the S.T.400.

This is an exuberant but not extravagant

comparison. Let me tell you in what way the "One-Point-Five" will wipe the floor with what has no doubt been a faithful servant to you for a couple of years, and which you are reluctant to condemn. I myself am the last person to criticise the S.T.400 lightly. Only incontrovertible evidence in actual practice and the evidence of many accurate measurements prompt me to say that you will be "amazed"—that grossly over-worked verb—at the improvement over your S.T.400.

As regards evidence in practice I want you to bear in mind that any comments on the S.T.600

Note that a screened coil is used for the H.F. tuned circuit, while an S.T.400 anode coil is retained for the detector coil.

made by those who have built or heard that set are evidence of the merits of the "One-Point-Five," since the two receivers resemble each other so closely. The essential features of the S.T.600 are:

- (a) The Extractor circuit, for cutting out local station interference.
- (b) The H.F. pentode detector which gives very great sensitivity.
- (c) The individually-applied-double-reaction system.*

Point-Five S.T.600 Features

As regards these features, the only difference between the S.T.600 and the "One-Point-Five" lies in the aerial reaction method, and while the S.T.600 scheme has merits in a one-knob tuning system, the somewhat different aerial reaction arrangement of the "One-Point-Five" is, nevertheless, highly effective when two main dials are used for tuning.

Much More Sensitive

Many of you, no doubt, have read my account of the S.T.600 and have examined the scores of letters from England, Scotland and Wales from those who have actually heard the S.T.600 in their own homes. Many of you will also have read the many

Terminals are not employed for the G.B. -1 and G.B. -2 connections. These are made direct to the battery by two continuous flex leads which pass through a hole in the terminal strip drilled near the tone-control knob. These leads are clearly visible in this diagram.

letters from those who have actually built this set. Anything said by such a reader as regards the Extractor circuit will apply equally to the identical Extractor circuit of the "One-Point-Five." In fact, almost everything said about the S.T.600 applies equally to the "One-Point-Five," so that all builders can feel as

much confidence in commencing the "One-Point-Five" as if this set had been on a great tour of Britain and had been vouched for by innumerable constructors like yourself.

Exactly why is the "One-Point-Five" so vastly better than the two-year-old S.T.400? An examination of the circuit will reveal the essential features which are different.

The receiver, like the S.T.400, consists of an H.F. amplifying valve, a detector and two low-frequency

amplifying valves. As regards valves, the only one that has been altered is the second, which is now an H.F. pentode detector. By the use of this valve an output of 5 times the volume of the S.T. 400 is obtainable. Of course, the output valve, being the same, cannot produce any more volume than in the S.T.400, but I mean that scores of foreign stations can be more easily received at full loudspeaker strength. Even if con-

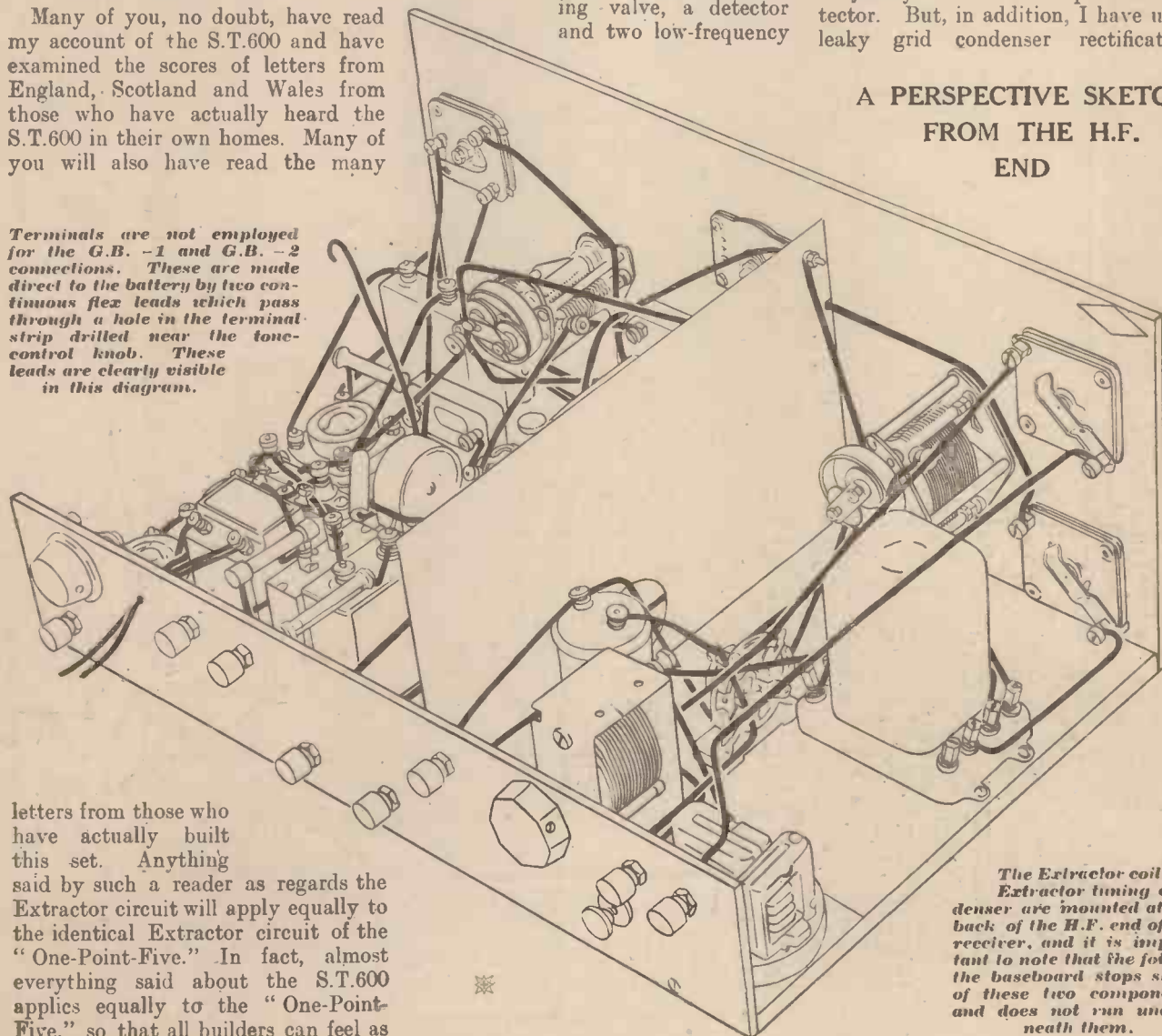
SUITABLE LOUDSPEAKERS FOR THE "ONE-POINT-FIVE"

W.B., Rola, Amplion, Blue Spot, Celestion.

ditions are poor, or if a small aerial is used.

This increase of sensitivity of five times would, of itself, be sufficient to justify the use of a pentode detector. But, in addition, I have used leaky grid condenser rectification

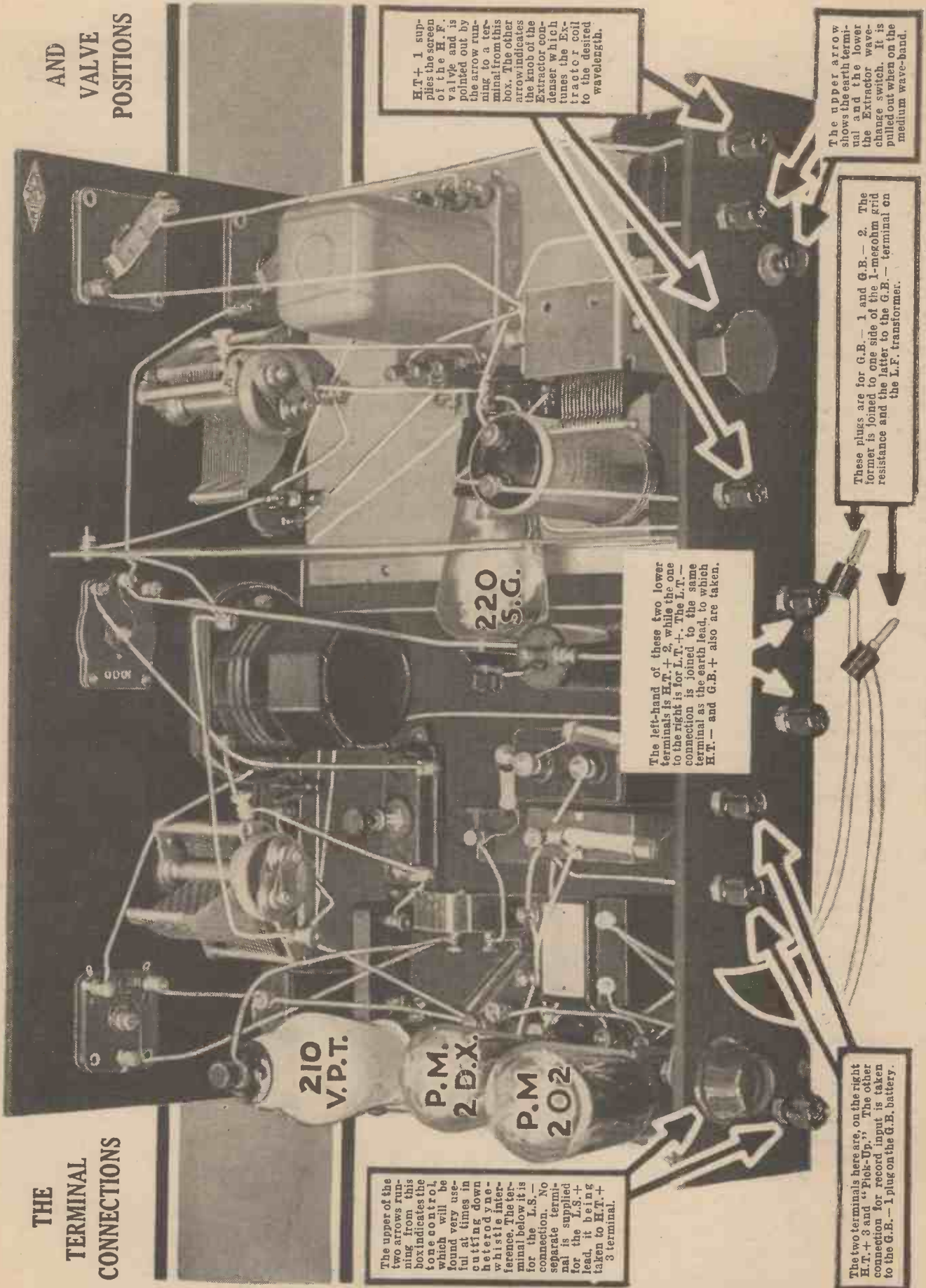
A PERSPECTIVE SKETCH FROM THE H.F. END



The Extractor coil and Extractor tuning condenser are mounted at the back of the H.F. end of the receiver, and it is important to note that the foil on the baseboard stops short of these two components and does not run underneath them.

AND VALVE POSITIONS

THE TERMINAL CONNECTIONS



H.T.+ 1 supplies the screen of the H.F. valve and is pointed out by the arrow running to a terminal from this box. The other arrow indicates the knob of the Extractor condenser which tunes the Extractor coil to the desired wavelength.

The upper arrow shows the earth terminal and the lower the Extractor wave-change switch. It is pulled out when on the medium wave-band.

These plugs are for G.B.— 1 and G.B.— 2. The former is joined to one side of the 1-megohm grid resistance and the latter to the G.B.— terminal on the L.F. transformer.

The left-hand of these two lower terminals is H.T.— 2, while the one to the right is for L.T.—+. The L.T.— connection is joined to the same terminal as the earth lead, to which H.T.— and G.B.—+ also are taken.

The upper of the two arrows running from this box indicates the tone control, which will be found very useful at times in cutting down whistling interference. The terminal below it is for the L.S.— connection. No separate terminal is supplied for the L.S.—+ lead, it being taken to H.T.— 3 terminal.

The two terminals here are, on the right H.T.— 3 and "Pick-Up". The other connection for record input is taken to the G.B.— 1 plug on the G.B. battery.

Pentode Detector Gives Great Sensitivity

instead of "anode bend" as in the case of the S.T.400. By the use of a very small grid condenser, in this case .00005 mfd., as against the .0003 mfd. which used to be popular, a great improvement in selectivity is obtained, not greater than with anode bend, but definitely greater than the selectivity given by the more usual values of grid condenser and leak.

The sensitivity, however, is about three times that of anode bend, so that on this valve alone we have a

total improvement of about 15 times. This, of course, is a tremendous advance in sensitivity. In fact, an

improvement of only one quarter would really be sufficient to justify the publication of a new design, while an improvement of 50 per cent. would definitely warrant the alteration of an existing set. But when the improvement is actually 1,500 per cent., then surely here is a receiver which will have an irresistible appeal to every S.T.400 owner.

But this question of sensitivity depends not only on the valves and the circuit used, but on the steps which have to

SUPPLIES FOR THE "ONE-POINT-FIVE"

That the publication of a design by Mr. John Scott-Taggart is a signal for unprecedented activity on the part of home constructors is a fact well known to manufacturers, and, in consequence, whenever a new S.T. design is announced, elaborate precautions are taken by those manufacturers concerned to ensure adequate stocks of the components used by the designer.

But the recent publication in our sister journal, "Popular Wireless," of Mr. Scott-Taggart's phenomenally successful S.T.600 was a record-breaker with a vengeance, and despite the usual elaborate precautions on the part of the manufacturers to guard against the possibility of shortages, the actual demand for components exceeded the most optimistic expectations. In consequence, it is regretted that certain delays were inevitable.

In the design of Mr. Scott-Taggart's "One-Point-Five" receiver, certain of the components—including the Cossor 210 V.P.T. valves—of which there was a shortage last time have been used again, but the Editor of WIRELESS AND TELEVISION REVIEW has been in touch with all the firms concerned, and has received personal assurances from responsible executives that the difficulty will not be experienced again.

Readers of WIRELESS AND TELEVISION REVIEW may therefore embark immediately upon the construction of the "One-Point-Five" receiver without fear of delay in supplies.

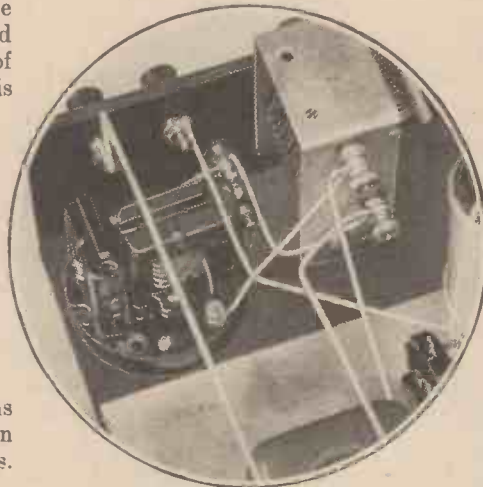
THESE ARE THE PARTS FOR MR. SCOTT-TAGGART'S LATEST DESIGN

Component.	Make Used by Designer.	Suitable Alternative Makes.
1 L.F. transformer	VARLEY Niclet (Standard 1 : 3.5)	Ferranti A.F.8, R.I. Hypermite
1 Coil	WEARITE Universal "Type A"	Wearite
1 S.T.400 or S.T.500 anode coil	COLVERN	J.B., Polar No. 2
2 .0005-mfd. variable condensers	ORMOND R.493	Polar, J.B., B.T.S.
1 Aerial Coupler .0005-mfd. solid dielectric variable condenser : log mid line	GRAHAM FARISH (Litlos)	Polar, J.B., B.T.S., Ormond
1 Aerial reaction .0003-mfd. solid dielectric variable condenser : log mid line	GRAHAM FARISH (Litlos)	
1 Anode coupler .0001-mfd. differential condenser	B.T.S.	Graham Farish, J.B., Bulgin
1 Anode reaction .0003-mfd. differential condenser	POLAR	Graham Farish, Ormond, J.B.
1 .00075-mfd. variable condenser for tone control	POLAR (Compax)	
1 Selectivity range adjuster, .0003-mfd. preset	GOLSTONE	
1 .0005-mfd. air dielectric variable condenser for Extractor tuning	ORMOND types for S.T.600, complete with knob	Polar No. 4 direct drive, J.B. Popular Log, Formo direct drive
1 Extractor coil as for S.T.600	COLVERN Ferrocart	
1 Extractor switch, on-off type (Junior type S.38)	BULGIN	Benjamin, Wearite
1 Aerial wave-change switch	BULGIN (3-spring S.36)	W.B., Wearite
1 Anode wave-change switch	BULGIN S.22	Benjamin, W.B., Wearite
3 4-pin valveholders	BENJAMIN Vibrolders	
1 S.G. valveholder (horizontal)	W.B. (Universal)	
1 S.G. H.F. choke	GOLSTONE Super H.F. Choke, R.4/452	Telsen Binocular
1 Reaction choke	B.T.S.	Graham Farish "Snap"
1 .0003-mfd. tubular condenser	T.M.C.-HYDRA	
1 .00005-mfd. mica condenser	LISSEN	Dubilier, T.C.C.
1 .006-mfd. mica condenser	GRAHAM FARISH	Dubilier, T.C.C., Lissen, Bulgin
1 1-mfd. condenser (for decoupling screen of S.G. valve)	DUBILIER 9200	
1 2-mfd. condenser (detector anode decoupling)	T.C.C. Type 50	Dubilier, T.M.C.-Hydra, Graham Farish, Amplion
1 1-mfd. condenser (detector valve screen decoupling)	T.C.C. Type 50	Dubilier, T.M.C.-Hydra, Graham Farish, Amplion
1 2-mfd. condenser (1st L.F. anode decoupling)	T.M.C.-HYDRA, 250 v. working	Dubilier, T.C.C., Graham Farish, Amplion
1 1-megohm grid resistance for 1st L.F. valve	FERRANTI Type G.H.1	
1 1-megohm resistance (grid leak)	ERIE 1 watt	Dubilier, Graham Farish, Ferranti
1 300,000 ohm resistance	FERRANTI Type G.H.1	
1 25,000 ohm resistance	ERIE 1 watt	Dubilier, Ferranti, Graham Farish
1 20,000 ohm resistance	DUBILIER 1 watt	Ferranti, Graham Farish, Erie
1 75,000 ohm resistance	DUBILIER 1 watt	Ferranti, Graham Farish, Erie
1 Toggle on-off switch	BULGIN S.80	
8 Terminals : A, E, H.T. +1, H.T. +2, H.T. +3, L.T. +, L.S. -, Pick-up	BELLING & LEE Type R	Clix, Bulgin
7 Wander-plugs, G.B. -1, G.B. -2, H.T. -, H.T. +1 H.T. +2, H.T. +3.	CLIX	Bulgin, Belling & Lee
2 L.T. Spade terminals	CLIX	Belling & Lee
1 S.T.400 screen	PETO-SCOTT	
1 Panel (ebonite), 16 in. x 7 in. x 3/16 in.	PETO-SCOTT	
1 Baseboard, 16 in. x 10 in. x 5/16 in.	PETO-SCOTT	
1 Cabinet	PETO-SCOTT	
1 Earth sheet of metal foil, 7 in. x 7 1/2 in.	PETO-SCOTT	
1 Terminal strip, 16 in. x 3 in. x 3/16 in.	PETO-SCOTT	

VALVES.—220 S.G. COSSOR, 210V.P.T. COSSOR, P.M.2D.X. MULLARD, P.M.202 MULLARD.

be taken to give the degree of selectivity desired. Every owner of an S.T.400 knows that there are acute problems to face; one is the elimination of the local station, and the other the ordinary selectivity required to separate two foreign stations of whatever similar strength. There is not the slightest doubt that the local station problem is the greater, and by the use of the Extractor circuit, the local station interfering on a particular part of the dial can be extracted, so that it is reduced to the same strength, if desired, of a weak foreign station. This is done by the Extractor circuit, without in any way altering the general sensitivity of the set. In this respect, the conditions are utterly different from those on the S.T.400 or other straight receivers.

THE WONDERFUL EXTRACTOR CIRCUIT



"The great ease with which the local can be cut out makes for much greater simplicity of tuning, since one is only concerned with receiving the foreign stations without having to bother about cutting out the local one."

Interference Cut Out

In the case of the S.T.400, for example, you know that when you are trying to receive a station somewhere near a "local" in wavelength, you have to reduce the couplers, both aerial and anode, i.e. turn them to the left. The moment you do this, of course the whole sensitivity of the set falls off, since the aerial coupler is reducing

the input, while the anode coupler is reducing the H.F. amplification of the first valve. Although aerial reaction properly applied can do much to balance this loss of sensitivity, it is

experienced nevertheless, and sometimes the reduction in coupler reduces the strength of the desired signal so much that it ceases to be of any value.

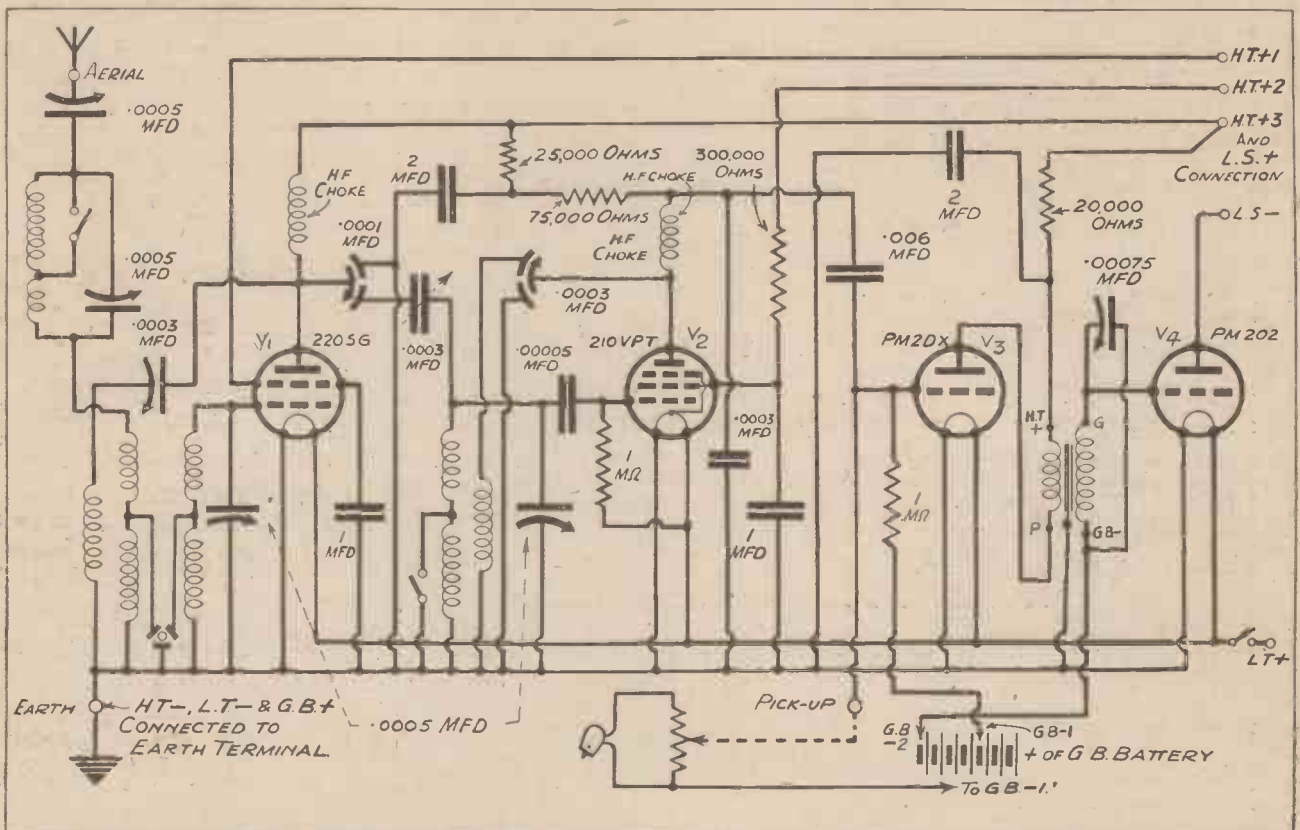
In the "One-Point-Five" there is still an aerial coupler (this time of .0005-mfd. capacity), and also an anode coupler. It will be found, however, that a local station, or Droitwich, can be at once cut out by the Extractor condenser knob, without having recourse to a reduction of the two couplers.

Astonishing Figures

If you are not faced with any local station problem, and Droitwich is not a trouble, then there is no particular advantage in having the Extractor circuit, although actually I have found it useful for cutting out interference from foreign stations next in wavelength to some foreign station I desire.

If, however, you live within 100 miles of a local Regional station, the perhaps unexpected benefit of the Extractor circuit is that sensitivity (I am not referring to selectivity now) will rapidly increase as you approach the local station. In London, for example, the use of the Extractor can easily make the whole set ten times

SCREEN-GRID H.F. PENTODE DETECTOR—TWO TRIODE L.F. AMPLIFIERS



Double reaction, individually applied, is one of the chief features of the circuit of the "One-Point-Five." The .0003-mfd. differential condenser controls detector reaction, while the .0003-mfd. "ordinary" condenser controls aerial reaction.

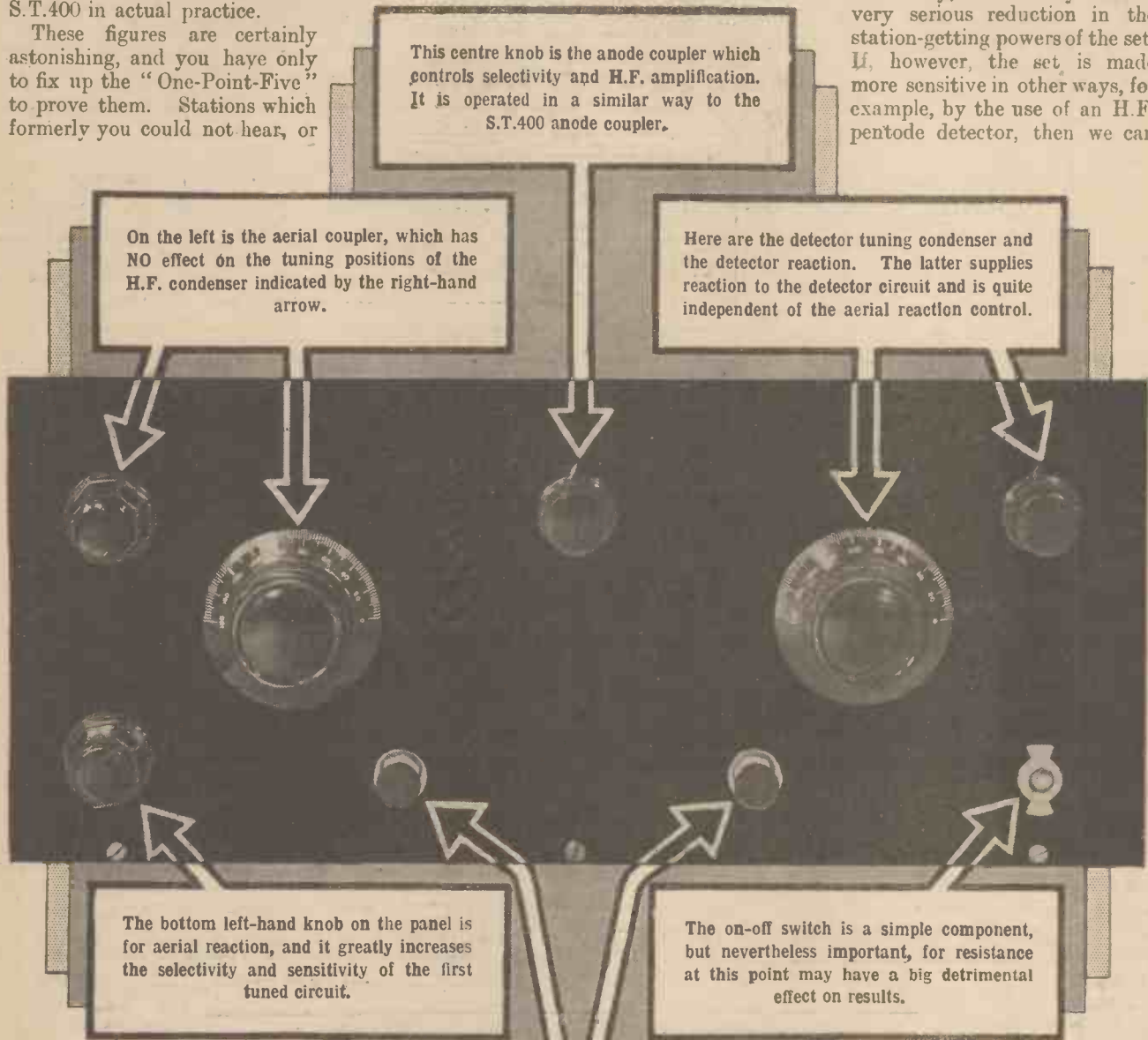
more sensitive, since larger values of couplers can be used, while maintaining selectivity. As we already have a receiver 15 times as sensitive as the S.T.400, it is clear that the complete set with Extractor will quite likely be 150 times as sensitive as the S.T.400 in actual practice.

These figures are certainly astonishing, and you have only to fix up the "One-Point-Five" to prove them. Stations which formerly you could not hear, or

THE CONTROLS THAT ELIMINATE ETHER CHAOS

the set), results were obtained which were better than with most receivers tied to a full-size outdoor aerial.

Sensitivity has its effect on selectivity. For example, cutting down the couplers on the S.T.400 improves selectivity, but it may cause a very serious reduction in the station-getting powers of the set. If, however, the set is made more sensitive in other ways, for example, by the use of an H.F. pentode detector, then we can



which were very faint, now fill the room at full entertainment strength.

During a tour of Britain with the S.T.600 last autumn, I regularly brought in scores of stations without any aerial at all; at least, the aerial consisted simply of the wire (inside the cabinet), which went to the aerial terminal, a matter of a few inches. In England, Scotland and Wales, Radio Normandy was heard at full loudspeaker strength without an aerial, while with a few feet of wire carelessly slung in the room (for example, between the door and

There are two wavechange switches, one two-point and one three-point. They are both pulled out for medium waves and pushed in for long.

still get stations at full loudspeaker strength even with the couplers at their reduced values, hence the greater sensitivity of the "One-Point-Five" contributes greatly to the selectivity of this new set.

As regards the cutting out of local interference, I may mention that the S.T.600 was designed at Brookmans Park itself in the joinery shop of Messrs. Shadbolt & Nash. For weeks I was engaged on the problem of cutting out the local station and the Extractor circuit in combination with the input circuit provided the solution. This

"As regards operation, the 'One-Point-Five' is simpler and more straightforward than the S.T.400, partly because the aerial coupler does not affect the tuning of the left-hand dial, and secondly, because the aerial reaction which is used on this set is better to work and considerably more effective than on the S.T.400."

Local Station



The "One-Point-Five" ready for the ether.

input arrangement of Extractor, aerial coupler, and H.F. transformer, is exactly the same in the "One-Point-Five" as in the S.T.600.

The Extractor circuit consists of an extremely efficient tuned circuit inserted in the aerial lead. A switch enables it to be worked on either the long waves or the medium, and you should incidentally make sure that you are on the right waveband when using the Extractor circuit. The Extractor is really an extremely efficient rejector

"Stations which formerly you could not hear, or which were very faint, now fill the room at full entertainment strength."

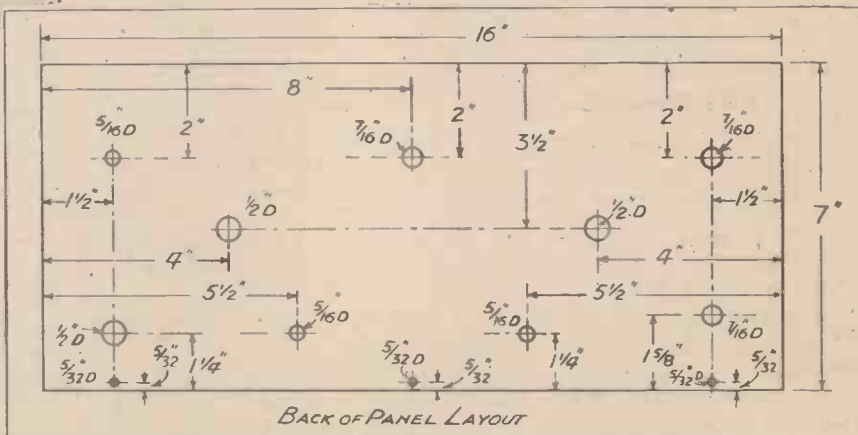
circuit, but frequently more conventional terms suggest arrangements which have in the past proved failures. In order to get the maximum rejector effect, iron-cored coils are used (for the first time I believe) and an air tuning condenser is employed. Nothing approaching such a rejector has previously been attempted in a broadcast receiver and it is, moreover, vital that the circuits with which it is associated should be suitable. It would be no use connecting an Extractor circuit in series with the aerial lead of an S.T.400, for example.

As regards the long waves, the Extractor circuit is just as efficient—in fact even more so—and at Birmingham it was just possible to receive the Deutschland-sender station clear of Droitwich, while all the other long-wave stations were clear.

As this was at 18 miles from Droitwich and as the Extractor has also been tested at one mile from a Regional station, its effectiveness may be judged. At one mile from the London Regional station it was possible to get

Hamburg on one side clear and Berlin on the other. Similar results were also obtained on either side of the National programme. It is, of course,

created by the use of aerial reaction. This aerial circuit is normally the most flatly tuned, but by the aid of aerial reaction signals normally inaudible can be brought up to full loudspeaker strength.

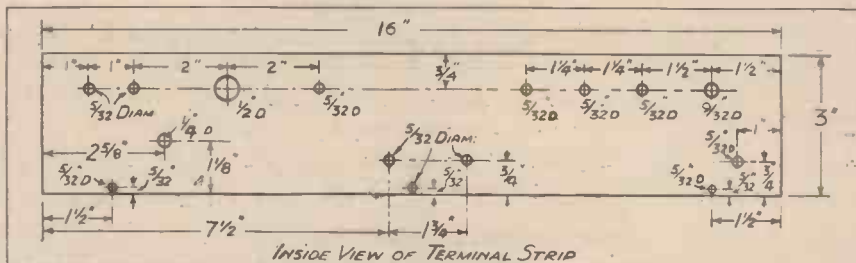


Note that this panel drilling diagram depicts the back of the panel. You simply have to mark out your own panel in a similar way before drilling the holes.

necessary to tune the Extractor circuit to the particular local which is causing the trouble at a certain portion of the dial, and within five miles of a B.B.C. station it is desirable to have two Extractor circuits, one of which may be outside the set if desired, or it may be included on the baseboard. I advise

"Only incontrovertible evidence in actual practice and the evidence of many accurate measurements prompt me to say that you will be amazed—that grossly over-worked verb—at the improvement over your S.T.400."

you to fit this as a later addition since it is desirable to design a receiver so that it is of greatest general utility.



Like the panel diagram above, the sketch of the terminal strip reproduced here is of the side on which the strip is marked out, namely that next to the baseboard.

The aerial reaction system on the "One-Point-Five" enables two doses of reaction to be applied to signals. The ordinary reaction is applied in the ordinary way by the anode reaction knob. The selectivity and sensitivity of the first tuned circuit is greatly in-

There is no need to elaborate on this as no doubt all readers have read my views on the subject in connection with the S.T.400, S.T.500 or S.T.600. The arrangement used in the "One-Point-Five" is the same as that which was employed in the S.T.500, except that a phase reverser has not been found necessary with the particular aerial coil employed. Provided the first valve is of the better type of S.G. valve, the results are excellent. Either aerial or anode reaction may be employed, or—in severe cases of interference or in the case of very weak stations—both may be used.

Easily Applied Reaction

I have a feeling that many users of the S.T.400 find that to obtain aerial reaction a certain amount of juggling is necessary, and so the full beneficial effects are not being obtained by the majority. This led me, in the S.T.500, to the conclusion that separate reaction on aerial and anode circuits was desirable.

In the "One-Point-Five," therefore, I have abandoned the distributor system. The result is that aerial reaction is far more definite and very easily applied, and in many cases

Interference Completely Removed

startlingly beneficial results have been obtained. There is, however, no need to use aerial reaction under normal conditions, and the aerial reaction knob can be left at zero (to the left).

Leslie A. Perrins, 101, Sycamore Road, Aston, Birmingham, 6.

"One Mile from Local"

I accompanied Mr. John Scott-

spread of the local station to a quite negligible amount and enabled many stations to be tuned in which were otherwise swamped.

W. H. Hurley, 122, Ramsay Street, Rochdale, Lancs.

REPORTS ON THE S.T. EXTRACTOR

Some excerpts from letters sent by enthusiasts who have experienced the S.T. Extractor at work.

When the Extractor was demonstrated it appeared as if the local station was being "faded out," and as soon as the tuning condenser was moved to the adjacent station on either side the local station might just as well have been closed down, for there was no indication that it was still radiating.

The supreme ease of accomplishing this effect was very noticeable, being nothing more than a knob adjustment, the setting of which was not at all a skilled job. With this Extractor set to North National the whole of the lower end of the broadcast range right down to Bournemouth was at your service, as the selectivity and ease of tuning made it possible to choose any one of the stations in this part of the dial.

N. Stanley Blackburn, 1, Parkville Road, Bell Lane, Bramley, Leeds.

"Most Effective"

Your device at the back of the set, which you explained was an Extractor to cut out the "local" station, proved most effective. Once set—and the setting only required a few seconds—it was never touched again, and it showed its worth when Fécamp was tuned in clear of Newcastle, a great test for a superhet receiver in this area.

Raymond Clare Seston, 7, St. Edmunds Road, Gateshead-on-Tyne.

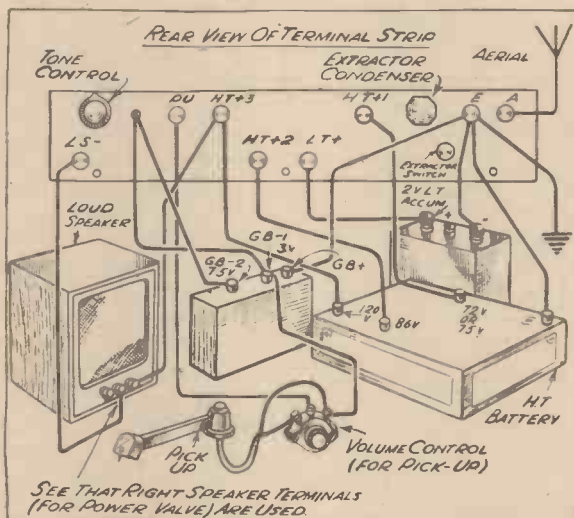
"The Greatest Boon"

The Extractor system fitted is the greatest boon that has been presented to the home constructor.

Geo. B. Harvey, 121, Corsock Street, Glasgow, E.1.

"Extremely Efficient"

The Extractor circuit is extremely efficient and the speed and ease with which it can be set is simply amazing.

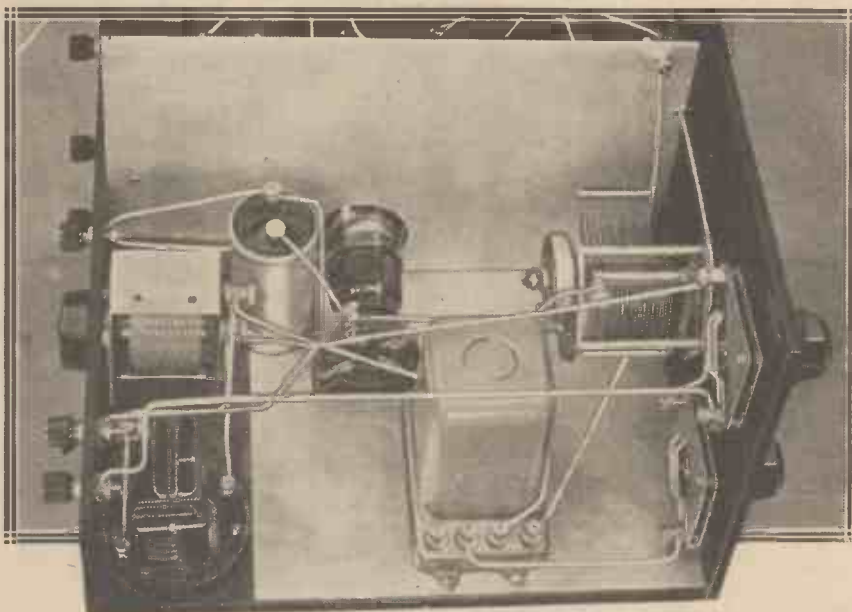


A pictorial representation of all the leads from batteries, pick-up, etc., to the back of the set, which will ensure correct connections.

Taggart in a test of the S.T.600 on an aerial at Slaithwaite, about one mile from the Moorside Edge transmitter.

duced to about 2 degrees either side of the right point, enabling all the rest of the long-wave stations to be

THE H.F. END OF THE ONE-POINT-FIVE



The arrangement of the metal on the baseboard at the H.F. end of the set is clearly shown in this view. The foil should run under the vertical screen's fixing down lug.

It was at once apparent that the general level of selectivity was high, and in a few seconds a slight movement of the Extractor cut down the

brought in without any background whatsoever.

W. Irons, 173, Gosset Street, London, E.2.



SHORT WAVE NOTES

The most important thing to the newcomer to short-wave reception is knowing just when to listen on the various wavelengths. This month W.L.S. deals with the matter in a very full manner.

SHORT-WAVE reception is truly a remarkable pursuit. You can have the best short-wave receiver in the world, and yet listen for twenty-four hours and hear nothing at all! Very few readers, doubtless, would be so unintelligent as to do anything of this sort, but it certainly is possible.

How, you ask? Well, it is quite simple, and the method is simply to choose, very consistently, the wrong wavelengths on which to listen. And it's easily done, too, if you don't know the ropes.

You see, the whole trouble is that "short waves," as we call them, are a tremendous expanse of frequencies. One can explore the whole of the medium broadcast band in a few moments, but complete exploration of the short waves would take a matter of some hours.

27,000!

To swish from Fécamp to Budapest takes a few seconds, and covers a band of about 900 kilocycles—room for 100 stations. But to cover our short waves really means going from 100 metres down to 10 metres—which, expressed in kilocycles, works out at 27,000 of them!

It is therefore vital that the short-wave enthusiast should, mentally, at any rate, sub-divide this vast ocean of his into smaller charted seas. He should know which part of it is most likely to be useful to him at a given time of day during a particular season of the year. He will thereby save himself much knob-twiddling and not a little brain-fag.

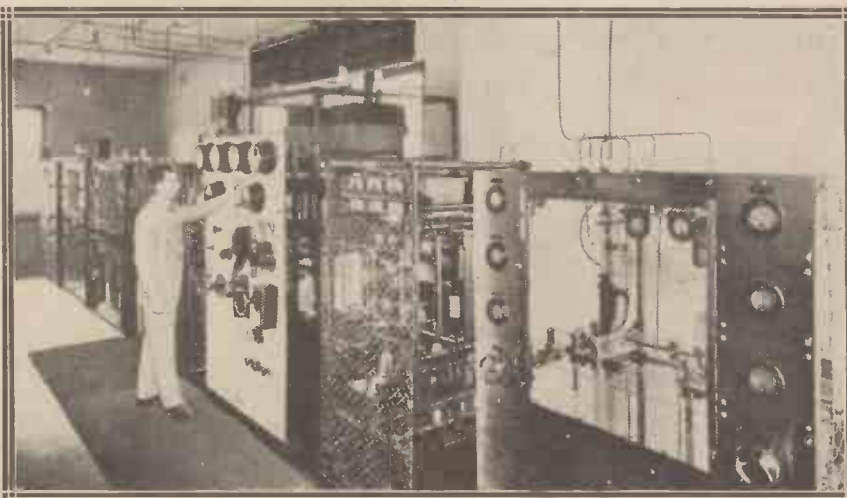
Let me make a very rough division for you. We will start with the band 100-50 metres. There is very little to interest the ordinary listener in this band, with the exception of the

amateur wave-band 75-85 metres. That is an "all-day" and practically an "all-season" wavelength.

Long-distance signals may be heard in the late evenings, most of the night and the early mornings, and stations up to 1,000 miles distant come over at any time of day or night. The other occupants of the 100-50-metre wave-band are all commercials, until one gets down quite near 50 metres and encounters the "overlap" of the 49-metre broadcast band.

The next convenient division is 50-30 metres. Over this band the seasonal variation is not very marked. That is to say, long-distance signals come in all the year round, provided that one chooses the right time of day

A STATION WELL-WORTH LISTENING FOR



This is the complete 20-kilowatt short-wave transmitter of VK2ME, in Sydney, Australia. It is situated at Pennant Hills, and works on a wavelength of 31.28 metres.

to listen for them. A good general rule is, "East in afternoons, West after dark."

This applies both to the 49-metre broadcast band and the 40-metre amateur band. Asia and Australia can be heard from 2 p.m. until 8 p.m., or thereabouts; America comes through at any time between 9 p.m. and 8 a.m. next day. Actually the Australian amateurs on 40 metres come round both ways, via Asia in the afternoons and via America (the longer route) in the mornings.

Europe (unfortunately) can be heard through most of the twenty-four hours. The strength of local stations is the chief disadvantage of these wavelengths.

The Various Continents

Below 30 metres we find a different set of conditions altogether, these waves being far more of the nature of daylight waves. The 20-metre amateur band is a fair specimen, and may be described in a few words. Long-distance signals can be heard at any hour of daylight, and for an hour or so before sunrise and after sunset. During complete darkness very little is heard, except in midsummer, when the Americans come through all night.

The best times to listen for the various continents during March on this band are as follows: Australasia 6-9 a.m. and 2-3 p.m.; Asia, noon to 4 p.m.; Africa, 4-7 p.m.; America, 11 a.m. till sunset, with occasionally the West Coast coming in at 6 a.m.

These remarks apply more or less to the 25-metre broadcast band. The 19 and 16-metre bands require a separate classification; 19 metres is

not used much for broadcasting from other continents than America. The two high-powered U.S.A. stations, W8XK and W2XAD, may be heard from noon till sunset (provided, of course, that their programme hours fit in with this).

16 Metres

The 16-metre band is essentially a daylight wave, and fades out some time before the 19.

Speaking very generally, it is safe to say that the strength of a station in a given locality, when conditions are favourable, will be greatest of all on the 16-metre band. As it is transferred to each band, going upwards, its strength will become slightly less, but its reliability greater.

From the short-wave broadcast listener's point of view, the 49-metre band is the most reliable of them all. It changes less from season to season than the others, and the rapid daily changes in conditions have less effect. By comparison with it, the 16 and 19-metre bands are quite freakish.

(Please turn to page 186.)

The Wireless Listeners' Circle



A special monthly feature devoted entirely to the interests of users of commercially-made receivers.



YOU cannot have started reading this article without having seen the question on this page—"Can I Afford It?"

It's a question that often crops up in modern life, and occurs in radio as in connection with other matters.

Personally I cannot pass the brightly-lighted windows of wireless stores with their rows of magnificently housed "radios" and radiograms, without pausing to inspect them. And without singling out one that specially appeals to me.

I expect most of my readers find just the same, too. But after the first glance the eyes tend to wander towards the little tickets bearing the various prices, and then, unless one happens to be on particularly good terms with one's bank manager, doubts begin to arise. Up pops that worrying question, "Can I afford it?"

Strange though it may seem, the answer is "Yes." You simply take advantage of your good credit and buy whichever is the receiver of your desire, by means of easy deferred-payment terms.

Wonderful Value Obtainable

Unless this should sound rather like a furniture advertisement, let me hasten to add that I mention it all because quite a number of people do not realise how little it is necessary to pay per week to obtain a really excellent instrument. And it is to this purpose that we are utilising the "Circle" this month. To show you what magnificent value can be obtained for a few shillings per week.

We do not stop at that, however. When a receiver is purchased on the deferred-payment system, as thousands and thousands are, one wants to be sure of getting something reliable, and also sure that it is going to prove just

Can I Afford It?

That is the question which exercises every listener's mind when he considers the various new set designs which specially appeal to him—and that is the question which we endeavour to answer for you this month.

On the following pages we deal with fifteen different receivers, all of which we have personally tested, which cost from as little as 2s. 6d. per week up to a magnificent model at approximately 9s. per week.

what is desired. And that is where the "Circle" this month will be of such value to the prospective buyer. Not only is a wide variety of types dealt with, but the models also cover a wide range of costs, and are grouped into three price sections to facilitate reference.

What is more, they are all of makes which we can recommend with the

utmost confidence. As a matter of fact they have all been through our hands for test, so that we speak with first-hand experience about them all.

In many cases you will find that we have quoted the remarks of ordinary listeners in connection with the receivers. These quotations are in many cases from special test reports we have previously arranged in conjunction with chance-chosen listeners, and give a useful impression of the sets from the point of view of the "man-in-the-street."

Perhaps a few words on how we have arrived at the cost per week of the various designs will not be amiss.

The deferred payments become due each month, so we have divided this amount by four, working on the basis of four weeks to the month.

Of course, if you want to be meticulously accurate you must reckon 52 weeks to the year, but this would give you rather odd amounts.

After-Sales Service

Finally, an extra word about the arrangement of deferred terms. It is practically a universal scheme for the manufacturers themselves to arrange and finance the whole matter.

At the same time the local agent who takes your order is always at your service if any after-sales troubles should arise. But these, let it be added, are few and far between with the modern standard of reliability.

So go ahead. Choose your set and enjoy to the full the joys of reception with one of the latest receiver designs.

A. S. C.

THE LISTENERS' CIRCLE—Contd.

COSSOR "350"

As you see, we are starting with the cheaper of the three price ranges with which we deal—sets that cost less than 5s. a week. Right at the bottom of the range comes the Cossor "350," amazing value at 2s. 6d. per week.

This table model receiver is self-contained and has a metal chassis. An idea of its internal layout may be gathered from the bottom photograph on this page, from which it will be seen that space for the batteries is provided at the back of the loudspeaker.

For those who desire to know just what it looks like from the front, there is the top photograph on this page. This photograph is actually of the "353," but varies in appearance from the "350" only in the minutest of details.

Cossor's have always realised the large number of listeners who work with batteries, and consequently have much past experience to draw upon when designing battery receivers. This has much to do with the large value for money obtained in the "350."

Apart from the S.G. H.F. valve the set, has a triode detector and output valves. The cash price is £6 12s. 6d. (exclusive of batteries). The hire purchase terms are 10s. deposit and twelve payments of 10s. per month.

COSSOR "353"

Having dealt with the Cossor "350" and mentioned the "353," it is only fit that we should go on to describe this latter receiver that looks so similar.

It also is a three-valve S.G. receiver, but employs pentode valves for both the detector and output stages. The price in this case is £6 17s. 6d., or 15s. deposit and ten monthly payments of 14s. These prices are exclusive of batteries, but note that there are only ten payments instead of the more usual twelve.

The chief feature of this receiver is that it incorporates the new "Super-Ferrodyne" development. This development, which includes the use of super-selective iron-cored coils, in conjunction with the variable- μ screened-grid circuit, ensures freedom from interference by powerful transmissions, even those working on wavelengths adjacent to the wanted programme.

Those who like good volume and high quality reproduction will know how heavy this may be on the batteries when an ordinary circuit is employed. They will therefore appreciate to the full the great advantage of the fact that the set uses an economy pentode output valve, which requires a minimum of H.T. current. At the same time it provides the finest quality of reproduction, and rounds off an altogether desirable instrument.

G.E.C. "Battery C.B.4"

Seventeen shillings a month is equivalent to four shillings and three pence per week, which is what you pay for the G.E.C. "Battery C.B.4" receiver. It is a four-valve receiver, and the cash purchase price is £9 17s. 6d., including all batteries and valves. In the case of hire purchase, the monthly payments extend over a period of one year, the initial payment also being 17s.

The "Battery C.B.4" is a handsome-looking console, as you can see for yourself from the third photograph down on the left. And, in keeping with its appearance, it also has a really handsome output.

The receiver has an unusually large, undistorted output which is combined with a quality of reproduction equal to that of a mains receiver. In spite of this, the average H.T. current when working at maximum volume is around 12 milliamps.

The output stage is of Class B type, which means that the current consumption will vary with the volume of reproduction. Variable- μ S.G. and screen pentode valves are employed in the H.F. and detector stages.

Single-knob tuning is provided, and the dial is calibrated in wavelengths. There is also a compensating device for adjusting the set to various aeriels.

Truly this is a set which will give of the best under all sorts of varying reception conditions.

ned in series), and are placed one on either side of the loudspeaker.

Those who are particularly anxious to see what the set looks like from the front should turn to last month's "Listeners' Circle" in WIRELESS. They will also find there details of an illuminating test carried out to see how far up the street a foreign station could be heard.

The price of this magnificent battery receiver, whose selectivity and general performance is more like that normally expected only from a mains outfit, is 11 guineas, or £1 10s. deposit and twelve monthly payments of 18s. 3d.—namely, about 4s. 6d. a week.

KOLSTER BRANDES "381"

The Master of Falkland sums up the Kolster Brandes "381" in these words: "Here, for the price of a suit of clothes, is a wireless set that seems to meet every need of the average listener. This K.B. '381' is a five-valve superhet, for A.C. and D.C. mains, easy to manage, good to look upon, and delightful to hear. The range is remarkable; you find the name of every worth-while station on the tuning-scale. And such quietness of background and tonal purity you don't always find in sets four times the price."

Well, that's a good enough introduction to a set! As you will gather, we have now come to a mains receiver as distinct from battery operated sets.

But there is no great advance in the price, for the K.B. "381" costs 10 guineas, and is obtainable for a first payment of 28s. and twelve monthly payments of 18s.—namely, 4s. 6d. a week.

The circuit is a four-valve superheterodyne arrangement, a fifth valve being provided for rectification. There is delayed automatic volume control, and a special built-in mains filter rejects noise from the mains.

There are many features to recommend this receiver, and the universal-supply operation is an added attraction for those who are on D.C. and may soon have their mains changed to A.C. The receiver is the second one down on the left on this page.

EKCO "65"

Finally, on this page, we have the Ekco "65," which is instantly recognisable by its unique shape. It is completely circular, the loudspeaker being housed in the centre with the station-indicating dial and the controls around it.

One of the chief advantages of this is that a large-size dial can be used. Consequently there is ample room for the station names.

There are only three controls on the front, the centre one being for operating the tuning. No doubt need arise as to which band the set is operating on, because an ingenious colour-code indicating system is adopted.

And now a word or two about the circuit. This is a six-stage superheterodyne arrangement for use on either A.C. or D.C. mains.

Some of the latest types of valves are utilised, including octode frequency changer, H.F. pentode, and double-diode pentode. Features of the receiver are long range, simplicity of operation, and magnificent quality of reproduction.

The price is 10½ guineas in walnut finish, and the "terms" are 19s. down and twelve payments monthly of 19s. For an extra half guinea the receiver is available in an attractive black and chromium finish.

MARCONIPHONE "257"

"The volume is simply amazing," and "I am at a loss to describe the quality, it's so wonderful," were two of the remarks of Mr. B. Kayes, of 3, Cromer Road, Tooting, when we demonstrated the Marconiphone "257" to him.

This receiver strikes quite a new line away from those already described on this page, since its circuit is of the superheterodyne type instead of being a "straight" arrangement. It employs four valves, but the H.T. current consumption is nevertheless remarkably economical.

An illustration of the receiver from the back is given by the third photograph down on the right. A feature worth noting is that two separate H.T. batteries are employed (con-





A portable Ekco receiver for universal mains operation, the "A.D.T. 95."

What you can get for 5/- to 7/- Per Week



An inside view of the Kolster Brandes "405"

Note the elaborate screening employed.

COSSOR "536"

What a lot of people who would very much like a radiogram instrument instead of an ordinary radio set, go without it just because they imagine the dual purpose outfit would cost more than they can afford, even in spite of hire-purchase terms. But, then, they cannot all have heard that the Cossor "536" only costs 5s. a week.

Even at this price it is a most attractively finished instrument, and there is nothing lacking in the quality of the reproduction. This is what a Music Critic had to say about it: "I have had a real treat the last week-end, for I have been using one of the latest Cossor radiogramophones. Radio on the Cossor was good, of course, but I was more than smitten with the brightness and fidelity of the record reproduction, especially on heavily-recorded full orchestral records."

Well, that's sufficient evidence of the reproduction quality, and a glance at the illustration in the bottom left-hand corner of this page will convince you of the attractiveness of the design.

The price is 16 guineas. Hire-purchase terms are: 40s. deposit and seventeen monthly payments of 20s.

EKCO "A.C.85"

Next we go a little higher up the price scale—to 5s. 7½d. per week, to be precise. And the set we come to is the Ekco "A.C.85," which is shown in the upper photograph in the centre of this page.

Like all Ekco receivers it is really unique in appearance. And the pre-selective-tuning control is also on the unique side.

The purpose of this control is to enable one to choose a desired station power beforehand, and then no stations that do not reach that standard will be rejected and there will be entire silence when tuning between them. This is what Mr. Hones, a postman of London, S.E.26, said, when he first tried out an "A.C.85":

"It's not only the quality. I admit that's just about perfect, but what I like is that slice of silence you get between the different programmes. Not a sound till the next station comes in full strength. That's a very appreciable point."

There is no doubt that at 12½ guineas this receiver is un-beatable value. Thirteen monthly payments of £1 2s. 6d. constitute the "terms" for this set.



This Cossor radiogramophone is wonderful value for its price of 16 guineas.

MARCONIPHONE "296"

"It's so very simple, and there are no 'ifs' or 'buts' about it at all. The cabinet also is so pleasing, it is neither ugly nor does it shout at you like some. Just refined and neat. Then there's the question of absence of interference, for we found all the usual ponks and bangs to which we are accustomed were entirely absent. We shall certainly miss it when it's gone!"

That is the opinion of Mr. W. H. Champ, of 73, Caithness Road, Mitcham, after having a Marconiphone "296" to try out for a day or two. And we heartily endorse his opinion in its entirety.

This A.C. receiver is fitted with visual tuning indicator, which eliminates the uncertainty of



Unique appearance characterises the Ekco "A.C.85" receiver to the left.



On the right is the G.E.C. "Superhet A.V.C.5" for use on A.C. mains.

tuning otherwise present with A.V.C. and also makes possible entirely silent tuning. The cash price is 13½ guineas. A deposit of £1 10s. secures the set, after which there are twelve monthly payments of £1 2s. 9d. to be made.

G.E.C. "Superhet A.V.C.5"

"It seems wonderful, but they are all as loud as each other," was how Miss Richardson, of Dunkesthorpe Road, S.E.26, summed up the station-getting powers of the G.E.C. "Superhet. A.V.C.5." She was acting, at the time, as a "chance-chosen" critic and the set in front of her was the lower one illustrated in the centre of this page.

Technically, this receiver is similar to the G.E.C. console model dealt with on the next page, but in this instance it is of consolette type. The price is of course, less, namely, 12 guineas. The hire-purchase terms work out at a deposit of £1 1s., and twelve monthly payments of a similar amount.

One of the many attractive features is the type of tuning indicator employed. In the words of the catalogue, this is a "full-vision luminous station indicator—distinctive colours for long and medium wavebands—moving white light for station names."

The set has a three-watt A.C. output which permits of magnificent volume without a single trace of distortion, the quality, as a matter of fact, being one of the outstanding good features of the design.

KOLSTER BRANDES "405"

The Kolster Brandes "405" was fully dealt with in the "Listener's Circle" last month, when a photograph showing how it looks from the front was reproduced. An inside view is seen in the top right-hand corner of this page, and shows clearly the mains resistance mounted on the side of the cabinet behind the loudspeaker.

Technically-minded readers will deduce from the presence of this resistance that the receiver is for use on A.C. or D.C. mains. It is also a transportable receiver and gives wonderful results without the addition of either an aerial or earth. The inner frame around which the aerial is wound is clearly visible in the photo.

The price is 15 guineas, or it may be obtained for a first payment of £1 13s. and twelve monthly payments of £1 6s. That works out at about 6s. 6d. per week.

EKCO "A.D.T.95"

And so we come to the last set we are going to deal with on this page—the one illustrated diagonally opposite to these words. There is no need to add the words, "Last but by no means least," since the receiver in question is an Ekco, the model "A.D.T. 95."

This transportable receiver is very striking, whether it be finished in figured walnut or black and chromium (which costs a few shillings extra).

"I am simply astounded at the volume obtainable, and particularly am I impressed with the strength at which foreigners come in," was the opinion of Mr. S. J. Clark, of 77, Caithness Road, Mitcham, when he tested this receiver at our invitation.

The circuit is one of the most modern and up-to-date used in any receiver to-day, and is a nine-stage superhet arrangement for universal mains operation.

It costs 6s.9d. per week, in twelve monthly amounts of £1 7s. and a deposit of £1 7s. also. The cash price is 15 guineas.



Excellent tonal quality is one of the features of the Marconiphone "296."

*THE LISTENERS' CIRCLE—contd.***G.E.C. "Console A.V.C. 5"**

ON this page we come to instruments of the more luxurious type. One of them, as a matter of fact, is a radiogram, and another a console superhet.

It is with the latter that we intend to deal first, the attractive instrument of which the photograph is shown on the right of this page. Dignity is perhaps the most noticeable characteristic of it so far as external appearances are concerned, but there are others which are noticed directly one begins to operate it.

Take sensitivity, for instance. In connection with this we cannot do better than quote Mr. E. Bowman, of 79, Caithness Road, Mitcham, who personally tested this receiver at his home for one of our special combined test reports.

All Stations

He said :

"I should think I have heard every station in Europe that's worth hearing during this last week-end, and what amazes me is that they nearly all seem to be up to the strength of the London stations."

Of the volume this listener said, "If you run the set all out it's enough to fill a hall—much too loud for any of my rooms." And, "It seems to me that the bass response is exceptionally good; on music it is much more true to life than one usually hears," were his remarks concerning the quality.

The price of this five valve superhet is 17 guineas, but it may be obtained for a first payment of £1 10s. and twelve monthly payments of like amount. And that, as you can work out in a moment, is just 7s. 6d. a week.

KOLSTER BRANDES "383"

A glance at the photograph of the Kolster Brandes "383" which is the bottom left one on this page, might easily lead one to conclude that it was of the console type.

Actually it is a consolette receiver, but the attractive housing which sets a new style

loudspeaker. The quality is always perfect, and even when the volume is turned down to a mere whisper the reproduction is just as good.

"It's a set that would appeal just as much to the real novice as to the man who knows something about radio, because, in spite of the stations that come in and their remarkable quality, the set is simplicity itself to operate. And the neon light which indicates when a station is properly in tune is a great advantage."

And you get all that for 19 guineas, or £2 3s. down and twelve monthly payments of £1 13s. (8s. 3d. a week).

The receiver is a universal mains model, by the way.

**MARCONI-PHONE
"Q/286"**

Under no pretences did we feel justified in leaving the Marconi-phone "Q/286" out of the "Circle" this month, but we could not make up our minds at first whether to include it under the heading on this page or to put it on the "What you can get for 5s. to 7s. per week" page.

The reason was that two alternative hire-purchase arrangements are available in connection with this receiver.

One works out at 5s. a week, and the other at 9s. 5d. per week. The reason for this difference is that the cheaper rate is over a period of twenty-four months, while the other is for twelve months.

The actual prices are as follow: 22 guineas cash, or £2 deposit and twenty-four monthly payments of £1, or 2 guineas deposit and twelve monthly payments of £1 17s. 8d.

"Full of Praise"

In praise of the set, which is a five-valve superhet radiogram for A.C. mains, we cannot do better than quote two listeners, who heard it at a demonstration we gave.

One said, "I think it is an instrument that is likely to satisfy even the most fastidious listener, and I am full of praise." And the other remarked, "Surely nobody could want anything better than this."



*Between
7/- & 10/-
Per week*

in radio cabinet work, gives it such an impressive appearance.

It is a seven-valve superheterodyne receiver with a variable selectivity control and quiet A.V.C., which may be varied to suit any reception conditions. A particularly impressive reproduction is obtained in virtue of the fact that two output pentodes are used in parallel

in the last stage.

And now for a personal opinion of a listener who tried the set out during a week-end at his own home.

"It's been quite a revelation to me," Mr. Denston, of 71, Caithness Road, Mitcham. "No matter how loud I turn it on I can't seem to overload the



Invitation to "P.P.E."—B.B.C. and Television—Sunday Morning Services—Winter "Proms"—Kazoo Band Concerts—A New Operetta

By Our Special Commissioner

laurels from ski-ing and skating competitions. I understand he will return with several coveted pots and trophies.

B.B.C. and Trade Unions

The B.B.C. is understood to have reaffirmed its decision to have nothing to do with trade unionism among members of its staff. There was some talk of an arrangement with the N.U.J. and other bodies, but the negotiations were abortive. All that the B.B.C. concedes is that, on the whole, its conditions and terms of employment do not compare unfavourably with those laid down by the recognised Unions. There is, however, no disclosure of these terms and conditions.

Television Plans

The development of television, necessitated by the implementing of

the report of the Selsdon Committee, will mean a new big organisation in the B.B.C. Amongst those mentioned as likely to be appointed Television Directors are Mr. Gerald Cock, the O.B. Director now, and Mr. Lionel Fielden of Talks, who is also in for the India job. There will be a dozen or so new posts to fill before the organisation contemplated is complete.

New Religious Service

The B.B.C. is to institute a new religious service on Sunday mornings, about 9.30. This will last for forty-five minutes, and will be sometimes from a studio and at other times from selected churches all over the country that can provide a congregation at that early hour. This will be a popular move. It should be accompanied, of course, with a further lightening of the entertainment fare of the rest of Sunday, and I understand that this also is being considered.

More Pot-pourris

Following the success of the pot-pourris produced by Dr. Julius Burger, the Viennese Professor of Music, the B.B.C. has commissioned three more to follow "The Life of Offenbach."

The first is called "City of Song" and will consist of Viennese light music covering the period from Mozart to Léhar; the second has been called "Liebestraum," and will feature Viennese love music, both romantic and gay; and the third, which promises to be amusing, has been given the title of "Round the World in Sixty Minutes."

(Continued on next page.)

Better Spirit at the "Big House"

IN and round the "Big House" these days there is a much better spirit than there was. I cannot offer any explanation of this; but there it is—the actual programme builders go about their tasks with much more enthusiasm and enterprise. There is also a much more marked feeling of co-operation, of the team-spirit generally. This augurs well for programme development in 1935.

"P.P.E." Back at the Mike

I hear that P. P. Eckersley, formerly Chief Engineer of the B.B.C., and deviser of the regional scheme, has been invited to be one of the high lights of a special programme depicting the events of the year 1921, in which he founded and conducted the famous pioneer British broadcasting station at Writtle, owned by the Marconi Company. P. P. Eckersley is a born programme man, and it is to be hoped that this invitation means the beginning of a regular association of the kind.

Sir Charles Carpendale Again Wins

Vice-Admiral Sir Charles Carpendale, Administration Controller of the B.B.C., now in Switzerland recuperating from a year's specially hard work at the "Big House," has once again emerged with



The Henderson Twins who owe their first B.B.C. broadcast to a record they made while under tuition at the School of Broadcasting. They are only thirteen years old and are the daughters of Dick Henderson, the comedian.



"A STOREHOUSE OF RADIO KNOWLEDGE"

Read what Mr. Baxter and other enthusiastic readers say about Mr. John Scott-Taggart's latest masterpiece.

Dear Sir,—I have just put down a copy of Mr. Scott-Taggart's "Book of Practical

Radio." What a storehouse of radio knowledge it is!

I am sending a copy to Mr. Irving Potts, the President of this club. He takes a keen interest in English radio activities and I am sure it will find a prominent place on his bookshelf.

JOHN J. BAXTER.

*Newark News Radio Club,
215, Market Street, Newark, N.J.*

"VERY WORTHY COMPANION"

Dear Sir,—I have to acknowledge receipt of the "Book of Practical Radio," and am sorry to be so long in

doing so. It is a splendid book and a very worthy companion to the "Manual of Modern Radio."

Scotsmen always appreciate a bargain and I am no exception. Well, in the "Book of Practical Radio" I've certainly got one. I don't know how it can be done for the money asked. Both books are a complete radio library in themselves, they cover so much ground. Again thanking you.

D. G. STABLES.

*Pitmidden, Udny,
Aberdeenshire, N.B.*

P.S.—Many thanks for the Radio-rule given in the December issue. It is a splendid gadget.

"A FINE BOOK"

Dear Sir,—I wish to acknowledge the receipt of copy of "The Book of Practical Radio," and in offering my humble opinion it is as I expected, after reading S.-T.'s previous "Book of Modern Radio," or rather "Manual of Modern Radio," and should be appreciated by all who are earnestly

interested in the practical side of Radio. In closing I must thank you again for a fine book.

P. E. BISHOP.

*8, Council Houses,
Pratling Street,
Aylesford,
Kent.*

"A USEFUL ASSET TO ANY WIRELESS LIBRARY"

Dear Sir,—I beg to acknowledge receipt of the "Book of Practical Radio," which has come safely to hand. I feel I must congratulate you on producing such a useful asset to any wireless library.

F. W. SMITH.

*265, Menlove Avenue,
Woolton,
Liverpool.*

"SHOULD NOT BE MISSED"

Dear Sir,—Your "Book of Practical Radio" arrived here in good order, and after glancing through a few of the items I must say it's a gift at the money, and should not be missed by professionals or amateurs alike. I am a librarian, and I am speaking from experience when I say your book is miles ahead of any here.

THOMAS HYSLOP.

*The War Memorial,
Stevenston,
Ayrshire,
Scotland.*

B.B.C. NEWS

(Continued from previous page.)

This will be a medley of the music of all nations. Listeners who remember "Holiday in Europe" will renew acquaintance with the two young lovers who, in this medley, will continue their tour of the world.

Winter "Proms." to Go On

When the B.B.C. first introduced the idea of a short season of winter "Proms." no one could gauge with any degree of certainty what the public response would be, and so up to now the concerts have been purely experimental.

This year's season was so successful with "house full" boards in use on most nights, that it seems fairly certain that "Winter Proms." will become as much an institution as the more famous early autumn series.

End of Balance and Control

The "balance and control" department at Broadcasting House has now disappeared, and the personnel whose

duties played such an important part in programme presentation, have now been transferred to other departments where they will in future be known as "studio assistants."

They will work exactly as hitherto, with the exception that instead of being called upon to "balance" all kinds of transmissions, they will now deal with the programmes of the particular departments to which they are attached.

Five or six of the staff, under Stanton Jefferies, have gone to the music department, two or three, under Paul Askew, have gone to Variety and Light Entertainment, one has gone to Drama, and two to Talks.

The question of balancing Empire programmes has not yet been finally settled. It may be that this work will be shared by "studio assistants" from all departments, but it is more likely that the Empire department will have its own staff for the work.

Kazoo Bands

Those who heard the recent North Regional broadcast in the series entitled "Owt Abaht Owt" will

remember the short recital by the Wallsend Kazoo Band.

Now, some people may be surprised to learn, as I was, that Kazoo bands are a thriving institution in the North and that there are well over a hundred in the North and East districts alone. That being so, it will not be so much of a surprise to learn also that it has been decided to give a series of weekly concerts by Kazoo bands, the first of which will be heard towards the latter part of February.

A Kazoo? Yes, I suppose I should tell you what I know about the instrument. It looks like a kind of miniature submarine, is usually made of tin, and not what you would call an expensive affair. But if you don't know its capabilities in the hands and mouth of a proficient executive you are in for another surprise.

A New Operetta

Mark Lubbock is at present engaged in writing the music for a new operetta, the book of which is by Denis Freeman. I understand it will have a Ruritanian atmosphere. "Twelve months and a Day" is its title.

As We Find Them



NEW APPARATUS TESTED

Interesting reviews of the latest products submitted by radio manufacturers and traders for examination and test in our laboratories.

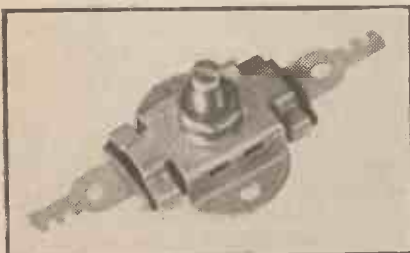
Goltone Components

Two very useful "Goltone" components have recently been submitted for test. One of these is a small potentiometer having a resistance of 30 ohms, and adjustable by means of a screw in a similar manner to a preset condenser. The component is styled the "Nodalizer," and its purpose is to eliminate the last trace of hum in a mains receiver.

As many readers will know, the use of the centre-tapping on the L.T. winding of a mains transformer does not always result in hum-free results. A method of overcoming this is to employ an artificial centre-tap with the help of a small potentiometer. The Goltone "Nodalizer" fulfils this purpose very satisfactorily, and its light weight enables it to be suspended on the wiring in cases where this is preferred. The "Nodalizer" costs 2s. 6d.

The second "Goltone" component is a second-channel whistle suppressor designed primarily for superheterodyne circuits. The great sensitivity and high selectivity provided by this class of receiver have earned for it a well-deserved popularity. But, by reason of the principle upon which the superheterodyne is based, there is a form of

PROVIDES A CENTRE-TAP



The Goltone "Nodalizer," a small potentiometer for connecting across the L.T. winding of a mains transformer in order to eliminate residual hum.

interference which sometimes occurs due to the powerful reception of one or more local stations.

This interference takes the form of whistles whose tuning points may often coincide with those of other transmissions. Moreover, the whistles are particularly prominent in instances where there is overloading of the valves preceding the intermediate stages.

The "Goltone" whistle suppressor is designed to eliminate this second-channel trouble and consists of an

A WHISTLE SUPPRESSOR



This coil unit is designed to eliminate second-channel whistles in superhets.

efficient coil unit having two medium-wave windings (there are, of course, normally two local stations which have to be dealt with).

The unit is wired in circuit so as to form a double wavetrap, each winding being tuned with a .0005-mfd. variable condenser. The device is then connected in series with the aerial and the condensers adjusted to eliminate the second-channel effect of the local transmissions.

The suppressor overcomes the necessity of using a small aerial so that a really efficient aerial can be employed, thus enabling the maximum results to be achieved from distant stations.

On test we found that the unit

fulfilled the claims made for it, the volume of the local stations being reduced to a reasonable strength and the whistles previously audible at various points on the tuning scale being eliminated.

Constructors who are troubled with this particular form of interference may obtain further details of the "Goltone" suppressor from Messrs. Ward & Goldstone, Frederick Road (Pendleton), Salford, Lancs. The price is 8s. 6d.

Bulgin Mains Resistance

Those who use indirectly-heated D.C. mains or Universal valves will be interested in the "skeleton" resistances which are being marketed by Messrs. A. F. Bulgin. A skeleton component, is, of course, one that is shorn of its external trimmings, such as polished cases. In other words, it is a component similar to those used by the commercial set maker, and the fact that it is not in a polished case does not in any way affect its efficiency.

In the case of the Bulgin mains resistance the "skeleton" construction actually enhances the efficiency because there is obviously better heat dissipation.

These Bulgin resistances are available in a comprehensive range of valves suitable for sets employing from two to seven valves, and for the different types.

In their "skeleton" form they cost 3s. 6d. and are excellent value.

FOR D.C. SETS

A Bulgin D.C. mains resistance of the "skeleton" type. These components are available in types to suit sets employing up to seven valves.



NEW DISTINCTION FOR VALVE PIONEER

Mr. John Scott-Taggart Elected Fellow of the Institute
of Radio Engineers

Recommended by the Marchese Marconi and Three Past-Presidents

It is announced that Mr. John Scott-Taggart has been elected a Fellow of the Institute of Radio Engineers.

This distinction is very rarely granted, and only to those who have attained the highest eminence in radio engineering.

We feel sure readers will join us in heartily congratulating Mr. Scott-Taggart, who so richly deserves this tribute which has been paid to his work as a pioneer of the valve era, as a brilliant inventor and as a distinguished radio-engineer.

Leading Radio Designer

To the public Mr. John Scott-Taggart is probably best known as Britain's leading radio designer; but many who use his inventions as a matter of course fail to realise that dozens of the valve manufacturing and circuit patents, many of them years before their time, are part of the very structure of modern radio science. A practical proof of the utility and priority of these inventions is that the greatest radio concerns in Europe and America have acquired these patents.

The vast popularity of his writings—and his latest "Book of Practical Radio" is an example—is due to his rare skill as an explainer and originator, allied to professional credentials of the highest grade.

Studied Patent Law

Mr. Scott-Taggart has specialised in inventions, and his interest in patent law led him to a study of the legal side. After obtaining a very high position in the Bar Final examinations he was called to the Bar in June, 1928. Although a qualified barrister-at-law, he has never practised as such, preferring to remain a consulting engineer, in which capacity he has advised the most prominent radio concerns in this country and America.

It is very significant of Mr. Scott-Taggart's eminence in purely technical and professional circles—as contrasted with his more "popular" activities—that he was recommended



JOHN SCOTT-TAGGART, M.C., M.I.E.E.,
F. Inst. P., Fel. I.R.E. Although a qualified barrister-
at-law, he has remained a consulting engineer and
physicist.

for this new distinction by his Excellency the Marchese Marconi himself and three Past-Presidents of the Institute of Radio Engineers.

The "I.R.E." has its headquarters in New York, and its international prestige stands very high. Its Fellows include such famous names as Marconi, Alexandersen, Hazeltine, Armstrong and De Forest. We believe Mr. John Scott-Taggart is the youngest Fellow, just as he was the youngest Fellow of the Institute of Physics.

Highest Diplomas

At thirty-seven he holds the three highest professional diplomas it is possible for a radio scientist to obtain: in electrical engineering, the M.I.E.E. (Member of the Institution of Electrical Engineers); in physics, the F.Inst.P. (Fellow of the Institute of Physics); and in radio, the Fel.I.R.E. (Fellow of the Institute of Radio Engineers).

There is only one other in this country who possesses all three distinctions.

Seal on Accomplishments

It is a matter of gratification to all who know the details of Mr. John Scott-Taggart's brilliant career that three such famous institutions have set the seal on his technical accomplishments by granting him the highest professional status it is in their power to award.

THE EDITOR.

How are the various dance numbers written? Is the music composed first and the lyric added to fit, or vice versa? Actually there is no fixed rule about song writing. Much of it is the result of sudden bright inspiration on the part of the composer or the lyric writer. Sometimes a small team of writers get together and,

pooling their ideas, often based on current topics, turn out a "hit." Sometimes sheer hard grind is necessary before a song is born, while in other cases twenty minutes sees the number through.

"The Isle of Capri" was born in melody form first, tango rhythm, and the tune suggested the name of a Mediterranean isle to the lyric writer, an island he had been reading about—Capri. That was enough to set off a train of thought. A few hours later the "hit" was launched!

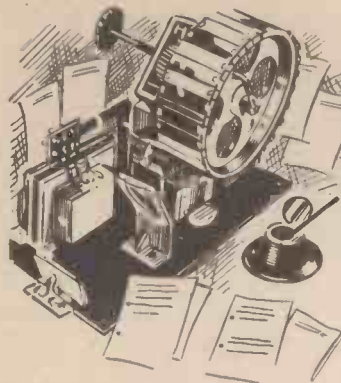
The title of the song is often the crux of the matter. Ray Noble got his "Good-night, Sweetheart" from hear-

ing two lovers part on a 'bus. "Stay as Sweet as You Are," was inspired by those words signed on an autograph album.

In a restaurant waiting for a long-since-ordered meal, two song-writers sat patiently. The waiter appeared, but passed them by. "Thought he was dead," said one.

"Yes, but he won't lie down," replied the other. "What a song title!" they both exclaimed, and the people in the restaurant were surprised at two unfed-but rapidly disappearing young men. They dashed out and wrote the number there and then. "He's Dead, but He Won't Lie Down!" became a great "hit."

And so it goes on—inspiration, hard work, half an hour spent in stringing an idea together, or weeks of steady grind at pen and piano. "Tin Pan Alley" is at work, night and day, to give us our dance music, some "hits," some flops—you never can tell the mood of the moment. K. D. R.



Notes on Television

by **DR J. H. T. ROBERTS F. Inst. P.**

Television in the U.S.A.—A New Synchronising Scheme—
The Latest German Cathode-Ray Tube—Television in Italy and
Denmark

You all know by now of the recommendations of the Television Committee and I will not enter into a discussion of their report here. But what will be news to you are the details I have received from a batch of American newspapers of the visit of those members of the Committee who visited the U.S.A. under Lord Selsdon.

The Committee visited the R.C.A. Victor Company's Laboratories in Camden, N.J., to witness a demonstration of Dr. Vladimir Zworykin's cathode-ray iconoscope. An official of the company stood before the cathode-ray pick-up equipment at one end in Camden and his image and voice were reproduced on the iconoscope receiver at the other end, where Lord Selsdon and his party witnessed the test.

The impression they left with their American hosts was that England would present television programmes long before the United States, not because the technique is more advanced here, but because of the B.B.C. monopoly, which merely has to sanction the idea in order to put it into effect. The competitive American system, on the other hand, necessitates the ironing-out of such economic problems as to who should bear the expense of the transmission, standardisation of equipment, and so on.

It certainly looks as if these impressions were right.

Outdoor Events

For those of you who may not be familiar with the details of the iconoscope, this instrument depends upon focusing an image of the scene which is to be transmitted on to a photo-electric mosaic.

Hitherto there have been many difficulties when using daylight, but the iconoscope, although not yet perfected by any means, seems

to get over many of these difficulties and to bring us a good deal nearer to the instantaneous televising of outdoor events. One of the troubles with the iconoscope, by the way, is the difficulty of controlling the sensitive cells.

A Rosy Future

I also notice from my American notes that Mr. David Sarnoff, President of the Radio Corporation of America, in a speech delivered at the New York University College of Fine Arts, spoke of television as one of the thrilling possibilities which radio has in store. "If we let our imagination plunge ahead," he said, "we may dream of television in faithful colours. We may then be shown reproductions of the treasures of the Louvre, have them interpreted to us as we sit by our firesides and see them through the air. Art in the radio age is the challenge to the genius of the artist and the vision of the educator."

A new synchronising scheme for television motors employs a phonic

wheel, in the usual way, but this has two stator windings. One of the windings is connected in the grid circuit of a suitable valve, whilst the other is in the anode circuit. When the armature is given a slight turn, fluctuating potentials are applied to the grid of the valve which produce corresponding fluctuations in the anode circuit, the core of the grid circuit stator being polarised. The grid and anode stators are so arranged in relation to one another that the motor runs at a speed at which the losses due to air resistance, friction, eddy-currents, and so on, are balanced by the power input to the rotor. When synchronising signals from the transmitter are applied to an auxiliary grid, the motor will run in step with the frequency of these impulses.

Many readers have written to ask me whether it is a very complicated business getting a television receiver together.

The best way I can answer is to tell you that there are on the market

already complete kits of parts for 30-line television receivers at prices of 75s. and 60s. British Television Supplies for instance, have a television kit ready for complete assembly with blue print and operating instructions, and which it is claimed any ordinary person should be able to assemble within an hour or two.

Two Versions

This kit includes a universal motor and stand, a 16-inch scanning disc, neon lamp and holder, two resistances and the necessary optical parts.

A receiver made up in this way can be used for mains operation or with a 6-volt battery, so long as 180 volts high-tension is available.



The members of the Television Committee who went to America. They are (left to right): Colonel Angwin, Lord Selsdon (chairman), F. W. Phillips, and Noel Ashbridge, Chief Engineer of the B.B.C.

The 60s. set is made by the Mervyn people, who are already well known in the television field. This includes a 15½-inch scanning disc, a Mervyn series-wound motor, with control and resistance, a "Nu-glo" lamp and all other necessary parts. Full particulars can be obtained from the Mervyn Sound and Vision Company,

A HOME-CONSTRUCTOR KIT



This disc-type viewer made by the Mervyn Sound and Vision Company.

Ltd, 4, Holborn Place, London, W.C.1.

Amongst the cathode-ray group of experimenters is Farnsworth of Philadelphia, U.S.A., who recently gave a public television demonstration. He focuses an image of the scene on to a special cathode-ray tube, by which means he obtains an "electron picture" and, by means of what is known as an "electron amplifier," the signal strength is amplified up. The whole of the picture is moved across an aperture for "scanning" by means of electric and magnetic fields.

Colour Television

Those of you who are interested in the progress of colour television should consult a Paper, read recently before the Royal Society of Arts, by Mr. J. C. Wilson, of the Baird Company's laboratories.

The paper is entitled "Trichromatic Reproduction in Television," and deals with the problem of television pictures

in natural colours, particularly with the Baird process, with which the Author has been mainly engaged. The paper is divided into two parts; in the first the circuits and apparatus used for colour television are described, whilst in the second there is a short discussion of the theoretical principles underlying the three-colour process. It is interesting to note that Mr. J. L. Baird produced colour pictures over a short line circuit as long ago as 1928 and demonstrated his results at a meeting of the British Association in Glasgow that year.

On the Continent

From Germany comes a report of a new type of cathode-ray television receiver in which a cathode-ray tube with a cold cathode is used. It is claimed that the cold cathode-ray tube gives very much greater brightness than the usual heated-cathode tube. The chief disadvantage is that a much higher voltage is required for operating the tube, but it is claimed that the great intensity more than compensates for this drawback.

I do not know whether you know, but the scanning disc used in mechanical television systems is sometimes alternatively called the "Nipkow disc," since it

was invented by Nipkow in Berlin in 1883, that is, some 50 years ago. It is said that Nipkow invented the scanning disc on Xmas Eve of 1883, and applied for his patent later.

A number of manufacturing companies are already at work making preparations for the inauguration of a television service in Italy. Generally speaking, the receivers which are being prepared for the market there are on similar lines to those in use in this country and in America. In Turin there is a 48-megacycle transmitter regularly used for experiments.

Those of you who have any television patents which you want to sell or exploit abroad should note that in Copenhagen a new Television Company has been formed, under the style of the Dansk Radio Fjernsyn. This Company is setting about the manufacture of television receivers, and I understand that it is anxious to buy the

Danish rights of any useful inventions.

If you operate a television receiver you may have noticed that there has lately been an improvement in the B.B.C. synchronising signal. Hitherto many experimenters have found that the signal was not strong enough to keep the set synchronised and it was very liable to "break away." With the improved signal, however, this is much less likely to happen and it is a comparatively simple matter to keep the picture steadily on the screen.

It seems to me that the sooner some international standard of definition is adopted the better. A new American Television Company is preparing television receivers which will use mechanical scanning of the 60-line mirror-drum type, and will later increase the definition to 120 lines. We seem to be going in for 240 line (or more) scanning. The firm has been working on the sets for over two years and is now going on to the market. It is associated with the Arcturus Radio Tube Company and the Sirian Lamp Company.

Film Recording?

A question which will soon come to the fore very much as television progresses is whether visual records should be made on a film, in the form of pictures as with present cinema films, or whether a record of the television impulses should be made, this latter being either upon a film or upon a disc. Already disc records have been made of television impulses and when these are "played" the impulses can be passed through a reproducer and converted into television pictures. In some cases a double track is used, a kind of two-start spiral, as it were, one of the tracks carrying the television or picture impulses and the other

The Mervyn "Nu-glo" lamp, which is suitable for various types of circuits. One of its features is that the high and low notes are fed into different electrodes.



carrying the sound which is, of course, synchronised with it. Another arrangement with disc recording is to use two separate (Please turn to page 179.)

SPECIFIED

FOR THE S.T. ONE-POINT-FIVE



It is a significant fact that of the thousands of letters received from delighted "Stentorian" users a large proportion tell of the unbelievable difference this astounding new Speaker has brought to their **old set**.

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STENTORIAN

(PERMANENT MAGNET MOVING-COIL SPEAKERS)

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Sole Agents in Scotland : Radiovision Ltd., 233 St. Vincent Street, Glasgow, C.2.

Sole Agents in I.F.S. : Kelly and Shiel, Ltd., 47, Fleet Street, Dublin.

NEW B.B.C. DIRECTOR WANTED?

Alan Hunter suggests that a new office should be created at Broadcasting House—to deal with the B.B.C. Programme Intervals.

WHAT the B.B.C. needs is a Director of Intervals. It should appoint one without more ado. Otherwise all these programmes of intervals will get out of hand.

Why broadcasting, latest branch of the entertainment world, should indulge in a throwback to the gay nineties is a mystery. In the old music-hall days, we know, the interval was often more entertaining than the acts.

The "pictures" have done a lot to kill the interval. Cinema managers realise people pay their one and sixpences to see the films, not to cast overt glances at each other's partners—or latest fashions.

Our radio is bringing back the interval, all the same. Not an advertised or intentional break, mind, but a sneaking sort of a break at frequent periods.

That is why I say we must have a Director of Intervals. His job would be a queer one. As Director without Portfolio his job would be to see that the interval was painlessly but effectively eliminated from all the programmes.

Intervals Not Wanted

Which brings me to the burden of my song. We don't want intervals in our wireless. The set's switch provides us, at our pleasure, with the ready means of lowering the drop curtain on the ether's entertainment.

Sometimes, as you hit upon a tune, it is difficult to tell whether the programme is from Daventry or from America—short waves are like that. But as soon as the tune ends you know.

The Empire station will give you ample time for a fragrant moment of inner contemplation. Not so the American. He will start talking immediately.

Don't imagine I am blaming the Empire stations. Or congratulating the American short-wave relays. They are simply reflecting in their different ways the policies of the medium-wave transmissions.

I do blame our system, though. Without wishing to Americanise our broadcasting I think it is valid to point out a fundamental raggedness. In my opinion it ought not to be divided up as though it were a series of disconnected side-shows.

A Case in Point

When it is so regarded the result, from the listener's angle, is aggravating. The other mid-day, for example, I tuned into London just as the announcer was saying there would be a three-and-a-half minutes interval before the next programme.

He had been playing records. A 10-inch record takes just about the time to play that I was treated to a



Larry Adler, who has broadcast in one of Henry Hall's Guest Night programmes, plays his mouth organ to Eddie Cantor, who is adding a "vocal refrain."

Great Silence. Hadn't that announcer any conscience? Or another record?

Probably he just did not visualise the listener's end at all; did not conceive that anyone might be just starting to listen. Yet people are always just starting to listen when the B.B.C. is thinking of ending.

Think what it meant to me. I had a quarter of an hour to spare. I wanted some music. I got it—for a few seconds. Then nearly four minutes of Bow Bells.

We don't want *broadcast intervals*. Not when we can provide our own so easily. When we turn on the wireless quite obviously it is because we want to listen to Something. Not to wait upon Nothing.

Not an Easy Job

Seriously, a Director of Intervals would be a good idea. With a stop watch he would have to go round to all the programme departments at Broadcasting House, checking up the time sheets by the split second. Not an easy job, admittedly.

Not impossible, though. The Americans, for an entirely mercenary reason, never tolerate an interval for even a fraction of a second. I've been listening to their programmes, so I know.

Someone there must have the job of seeing that there are no intervals. He may not be called the Director of Intervals. His function may devolve on the individual programme makers. More than likely they all work to split seconds as a matter of course.

Whatever the actual method the result is wholly admirable from the listeners' aspect. American broadcasting goes on, like the brook, for ever.

Perhaps it might be argued that only the casual listener suffers from intervals. But isn't that rather begging the question? We cannot surely be expected to attend a programme of light music with the same ceremony of going to Queen's Hall.

The Cause?

Yet what I might call the B.B.C.'s concert hall complex is partly the cause of the intervals. The programme builders tacitly assume we treat the wireless as though it were a concert-hall—as something that needed to be made a date with.

I refuse to believe that I need make a date with a programme of light music, for example; it does not matter to me whether I am going to hear "Poet and Peasant" or the overture to "William Tell."

So let us have that Director of Intervals. Give me a pile of records and a couple of fade units and I'll tackle the job myself.



From My Armchair

by
S.T.

This month Mr. Scott-Taggart has something to say to S.T.400 users who may contemplate converting their sets to the "One-Point-Five." Then, in his versatile manner, he switches over to such varied subjects as Inductance Weevils, Frequency Response, and Professor Eddy, forming a series of notes of exceptional diversity.

I THINK I have had more Monday mornings these last few months than for a very long time. At least, I have had a very great deal of correspondence.

Certainly as far as I am concerned, there seems no lack of interest in radio. The big event has been the S.T.600, of course. This month you get an S.T.400 users version. The cream of the S.T.600 is now added to the cold blancmange of the S.T.400, and the result is the "One-Point-Five."

A Marvellous Improvement

Now there are huge quantities of S.T.400's about the place. I am hoping they will all convert to the 1.5. It won't cost much and you'll only need one new valve. But what a marvellous improvement! The things you can do with it! The American stations you will hear on it!

It is, of course, not a better set than the S.T.600, but I think it is a little more fool-proof and manufacturer-proof. Anyone who is getting very good results from the S.T.400 has automatically tested and proved his components, speaker and batteries. The chance of trouble is extremely remote.

But if you should be one of those who has not had good results with the 400, the fault—whatever it is—will probably be passed on to the "One-Point-Five."

I once got a letter from a reader who built four of another designer's sets with complete lack of success; he then built the S.T.300 and got wonderful effects! I wrote to him to say he probably had a dud component which had gone into each of his four sets but which he was prevented from putting in the 300. And it was so.

So if you have a poor S.T.400, you'll probably have a poor "One-Point-Five" if you convert.

* * *

A reader in Exeter has asked for a couple of inductance weevils, which followers of these notes will remember caused so much coil trouble in Northumberland and other parts of the country. He says he wants them to be male and female so that he can breed them as pets.

Those who saw the micro-photographs will realise that I have been set a pretty problem. There is the further difficulty of the Post Office regulations; the Bishop of St. Edmundsbury and Ipswich (Dr. Whittingham) was recently hauled over the coals for having a caterpillar

AT THE MICROPHONE.



Miss Anona Winn and Henry Hall in merry mood during one of the famous "Guest Nights."

sent to him in a matchbox. Apparently you can send a leech or a bee by post, but not a caterpillar.

At my local post office I asked a very superior young lady whether I could send a couple of henrocites* by post. She directed me to the next window. I was told at this window:

"Parcels at the end of the counter." "Parcels" asked how much they weighed. I said about a trillionth of a milligram. She said letter-post was indicated. At the aperture marked "Stamps" I was asked if they were animals and if so, were they alive. I said that they hadn't moved or eaten for three weeks but that I felt sure that they were alive. She looked up the Post Office Guide and read out:

"Living animals can be accepted for special express delivery if they are confined in a suitable receptacle."

They'd Crawl Out

But what is a suitable receptacle? I am sure they'd crawl out of a matchbox. I think my Exeter friend had better come and collect them. It would also relieve me of a rather delicate responsibility.

* * *

From Ardwick, Manchester: "I have built every one of your sets, and all with the same amazing results. No signals whatever. The most I've ever received was a couple of trams and a Fair ground. The sets are a washout, the magazine's a washout and you're a washout."

The signature is "A. Hasbury." With all respect, Mr. Hasbury, I suggest you change the "H" to an "R."

* * *

Mr. Wm. Palmer, Jnr., of Clapham, S.W.4. has a lot to say about frequency response. He says: "By the way do not think I have forgotten that there are such things as low notes† but the upper register is of the greatest importance. This point has been admirably expressed as follows: *C'est de la partie de l'échelle* (Please turn to page 185.)

* Official name for the Inductance Weevil.
† He ought to see my Monday mail.

Practical HINTS FOR ALL



Some Topical Tips

By A. S. CLARK

THE first subject I am going to deal with this month is radiogram motors. Quite a number of the electric ones used in all-mains receivers are supplied with an automatic stopping switch which is also used to start the motor.

The type I have in mind is illustrated in one of the diagrams on this page. When putting on a new record, the following sequence of operations is usually adopted.

A Simple Scheme

The pick-up head is held in the right hand (after a new needle has been inserted) while the left is used to start the motor by moving the switch towards the pick-up arm. Now look at the wire loop shown fixed to the pick-up arm.

With this loop in place it is merely necessary to move the tone-arm a short way to the right to start the motor, and then to put the needle on the first groove. The left hand is not

AUTOMATIC STARTING



The addition of the wire loop makes it possible to start the motor by simply moving the pick-up arm momentarily away from the record.

needed, and the motor can be started whilst the left hand is still putting the used needle into its receptacle.

Perhaps this seems a somewhat trivial point to you—but try it, you will be surprised at the difference it makes. Incidentally, it is intended for pick-ups that swivel or lift at the end of the pick-up arm and not for

the type in which the whole arm lifts at the point where it is attached to the motor-board.

And now for the second diagram: I have been handling a number of different commercially-built receivers of late, most of which have the names of many stations given on the tuning dials. The result was, on coming to a set that was only calibrated in wavelengths, I felt quite lost for a time—in fact, had to draw up a tuning graph.

Gives Easier Tuning

Then a way of making the set that was calibrated in wavelength only, as easy to tune as the others occurred to me, and I pass it on for those who are similarly placed. Actually, I think the sketch makes the scheme almost obvious.

A scale, exactly identical in size and layout to the one on the set, is drawn up on a piece of card. Then, as stations are identified, their names are inserted on the newly-prepared dial against their tuning points.

As soon as a sufficient number of names have been inserted the card is fixed either by gluing or by some other means, as close as possible alongside the actual dial on the receiver. Due to its proximity and the similar marking, it makes the correct setting of the tuning for a given station almost as easy and quick to find as a normal station calibrated dial.

Attaching a Televierer

Only one waveband is illustrated for the sake of simplicity, but stations on both wavebands can be added just as easily.

I have another television hint for you this month. It concerns the use of a commercially-built receiver for attachment to a televierer.

In many cases a switch is provided for cutting out the incorporated speaker when working on the extension-speaker connections. When a set

has such a switch it is often ideal for use for television purposes.

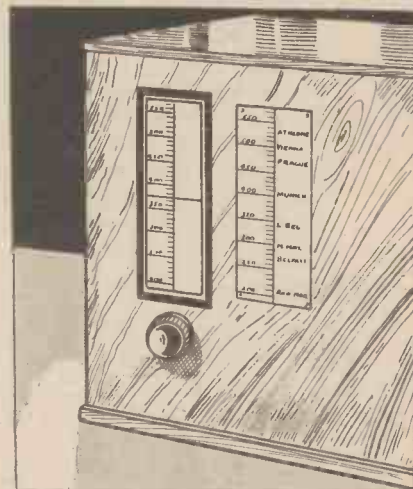
A Point to Note

The input for the televierer is taken from the extension plugs, and the set's internal speaker can be switched on and off as desired to check up aurally the tuning of the television sounds.

It is important, however, that a check should be made on the type of extension speaker the set should be used with. If it is of the high-resistance type, all is well and the televierer can be connected via an ordinary 1:1 ratio output transformer.

If, however, it is intended that a low-impedance extension speaker be

STATION CALIBRATION



The addition of a "dummy" dial carrying station names, placed close alongside the normal dial, is almost as good as having the set actually calibrated in station names.

used, then things are not quite so suitable and a special step-up transformer is necessary for good results.

Here is a suggestion for the experimentally-minded to develop. It is connected with the use of completely indirect room lighting and extension speakers.

By completely indirect lighting, I mean the sort in which an entirely opaque bowl is used below a powerful bulb, the light all being reflected off the ceiling.

The idea I am going to suggest is that the loudspeaker should also be housed inside the bowl. Of course, a small instrument would be needed and there would be little chance of using much of a baffle; but many would consider the unique effect well counterbalanced these drawbacks.

An "electric light" switch could even be mounted alongside the lighting switch proper to control the loudspeaker.

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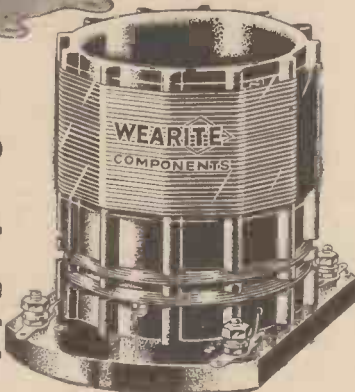
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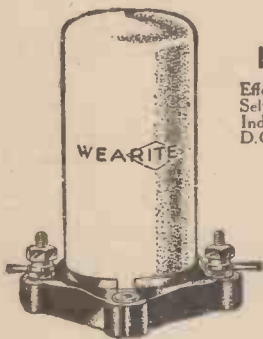


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Telephone: Woolwich 2345.

Questions I am Asked

Q. 122. Can I apply reaction to a band-pass tuner so as to give me greater selectivity?

A. It is a very risky business. You may get queer effects and poorer overall selectivity. A band-pass arrangement usually consists of two tuned circuits coupled in such a way that instead of a very sharp tuning point being obtained signal strength remains constant over a band of frequencies.

This band is often from about 5,000 cycles below the station's main (carrier) frequency to 5,000 cycles above. The whole arrangement is considerably more selective than one ordinary tuned circuit, but is less selective than two circuits very loosely coupled.

To get the right band-pass effect it is vital that the coupling should be just right and that both circuits be accurately tuned. A mistuning of one circuit will completely upset the band-pass effect and will probably give a marked double hump resonance curve, one hump being at a different height than the other. As the object of the band-pass circuit is to avoid high-frequency distortion, you must keep the conditions of the two circuits such that a "flat-top" resonance curve is obtained.

If you want to apply reaction to a two-circuit arrangement I advise you to make the coupling very loose—considerably looser than in a band-pass arrangement—and then apply reaction to the second circuit.

If a condenser of, say, .04-mfd. capacity is used as a coupling device, you could increase this capacity, thereby reducing the coupling. If "top capacity" is used separately or as well, you would *reduce* still further the already very small coupling condenser.

Q. 123. When my battery set is first switched on, an unpleasant crackly or rustling noise is heard, but in about a minute the noise disappears and the set is O.K. Can I stop this effect? Does it show there is something wrong?

A. There may be a loose contact somewhere, this loose or imperfect contact heating when that part of the set "warms up." And if the noise is



Some valuable answers by our popular contributor to questions of general interest that have been raised by readers.

of a creaking or rustling nature and only occurs when you switch on, the effect may be a "natural" one, i.e., one that is normal and about which you can't do anything. It is caused by the filaments expanding and slithering against the anchorages which hold them in place. Of course, it is not the actual slithering noise you hear but the result of erratic changes in anode current due to the "settling down" of the valves.

Q. 124. Can I use a metal rectifier as a detector of the usual broadcast signals?

A. Yes, but the arrangement is not as sensitive or effective as a crystal detector. Excessive damping, moreover, is thrown on to the tuned circuit and this cuts down selectivity as well.

Quite a different story can be told when dealing with lower-frequency currents such as those in the I.F. circuits of a superheterodyne. If the input signals are strong very nearly straight line rectification is obtainable, and it is almost impossible to overload this type of detector.

Q. 125. I have been advised to use two valves in push-pull. What does this mean and what are the advantages?

A. Push-pull is a system of using two valves and came into prominence in 1915. When amplifying low-frequency currents each valve does its share of amplifying, the outputs of the two valves being usually combined in an output transformer. The characteristic curve relating grid volts and anode current is not a straight line, but if we arrange that the anode current of one valve is increasing when that of the other is decreasing, we shall balance out the effects of the curvature of the characteristics. As the curvature causes harmonic distortion "push-pull" will stop this particular source of distortion. For a given percentage of harmonic distortion a greater loading of the valves is possible when they are arranged in push-pull.

Class B and Q.P.P. arrangements are not true push-pull. They are push-and-push circuits, each valve giving an electrical push in turn.

The superb "quality" given by my Super-Gram de Luxe is due partly to two stages of push-pull amplification.

Q. 126. Is there any advantage in using a variable grid condenser for detection?

A. Well, at one time we had everything variable. This was not due to a craze for knobs but because apparatus tended to function rather erratically. Valves particularly were kittle-cattle, and as each valve was a separate cattle as far as kittle-ness was concerned, it had to be coaxed to a critical operating point with rheostats, adjustable grid leaks, etc.

Nowadays, we try and avoid variables if we can. But experiments of a most interesting character can be carried out by using an adjustable grid condenser.

If you start at .0003-mfd. and reduce the capacity signal strength may even increase, due to a reduction of grid damping. Reaction will become weaker but you can usually bring it back with the reaction knob. Reaction will, however, improve as regards smoothness, as you reduce the grid condenser. Selectivity also improves owing to a reduction of grid damping. This led to my using .00005-mfd. as the value of the grid condenser in S.T.500 and S.T.600.

WIRELESS *in the* GREAT WAR



LONDON's water supply poisoned with deadly germs. . . . High explosive sufficient to blow a large part of the Metropolis to atoms. . . . Spies in the Savoy Hotel. . . .

This may appear like an extract from some novel by a shocker novelist, but, as a matter of fact, a very real plot to poison London's reservoirs and blow up the City was hatched during the Great War, and might have been successful had it not been discovered in time by the decoding of a casually received enemy wireless telegram.

One day an intercepted German wireless message was received at the Admiralty in London, and, on being decoded by secret cipher experts, stated that a Norwegian known as Alfred Hagn had left Holland for Harwich.

A Room at the Savoy

This man was already known as a secret service agent and was accordingly shadowed by Scotland Yard men, who thought it better to allow him liberty in the hope of obtaining some clue of his intentions—almost certain to be dishonourable.

Hagn engaged a room at the Savoy and, to watch him more closely a detective engaged a room adjacent. In spite of this vigilance, however, the detective could glean nothing very incriminating about the spy who seemed mainly interested in the topography of London. But there was one small point, Hagn seemed very anxious about one of his suitcases, and was particularly careful to see that no one ever touched it but himself.

Finally Scotland Yard became tired of waiting and having lured the spy away from the Savoy, thoroughly searched his room. Well it was, that they did so, for the mysterious suitcase

The Secret Service work which was carried out behind-the-scenes played a great part in winning the war. Many were the enemy plans that went astray through the skill of a secret branch of the Admiralty Intelligence Department. And once again wireless proved to be the vital link, as you will see from this fascinating account.

By "RADIAT"

contained phials of germs capable of poisoning thousands of people, and neat packages of high explosives sufficient to reduce the larger part of London to ruins. Apparently it was Hagn's intention to poison the water reservoirs of London and systematically blow up all the important points such as stations, post offices, and of course, the Houses of Parliament. What might have happened had that casual message not been picked up on the wireless and decoded, hardly bears

contemplation. Undoubtedly thousands of men, women and children would have been poisoned, dying possibly in great agony.

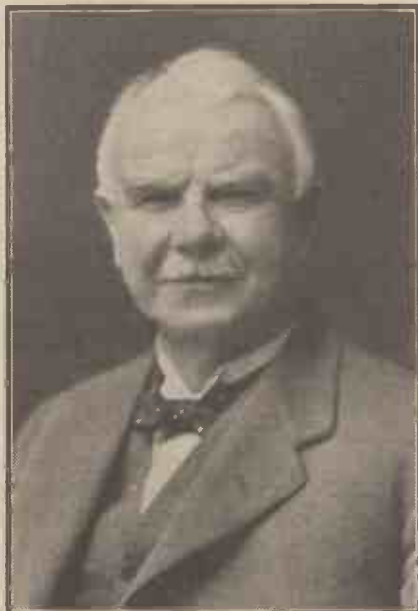
This is one of many secret service incidents in which wireless played an important rôle, and indeed wireless was, from our point of view, almost as valuable a factor in the Great War espionage as the spy himself.

At the outbreak of the War British warships cut all the outgoing North Sea cables from Germany, thus leaving the enemy only one method of communication with the outside world—wireless. Germany immediately commenced to develop and use her wireless system to the full, and particularly was this the case with her high-power station at Nauen which was largely used for communicating direct to Sayville, Long Island, in America.

Decoding Messages

As all messages were, of course, in code a special department was set up by the Admiralty for decoding these messages. So efficient did the decoding experts become that out of the two thousand odd messages which were picked up daily by our stations, not one remained undecoded; and in many cases proof was forthcoming that the British Admiralty had less difficulty in decoding the German signals than the German recipients themselves, who often found difficulty with their new and altered codes.

The Germans changed the keys to their codes at midnight every twenty-four hours, but this did not defeat the



The late Sir Alfred Ewing, a famous scientist, who was chief decoding expert at the Admiralty during the Great War. His invaluable work is referred to by "Radiat" in this article.

British experts for more than five minutes, and when in 1916, Germany brought in an entirely new naval code, the late Sir Alfred Ewing, who was chief decoding expert, was most amused to decode urgent and frantic telegrams sent from various German submarines and other sources to their headquarters in Germany asking for help in using the new code, how was it decoded and so on.

Sir Alfred Ewing was responsible for the erection of our enemy listening stations on the East Coast. All wireless messages sent out from Germany were copied down at these stations and telegraphed direct to the Admiralty in London, where they were decoded in that secret of secret dens, room 40 Old Building.

The German plans which led to the action at Dogger Bank were picked up by these stations twenty-four hours beforehand. We were forewarned about Jutland in the same way. Roger Casement's landing and capture in Ireland were also the result of this work. It will be remembered that the latter gentleman attempted to start a rebellion in that island. All Zeppelin messages, came through via the listening posts, and weren't these exaggerated? Almost every Zeppelin commander in turn boasted of having destroyed Tower Bridge, etc., etc. Many of them had, of course, reduced most of London to a complete and bloody ruin. Eventually even German Headquarters became sceptical of the reports of returning Zeppelin commanders.

A Famous Telegram

The greatest prize of all, however, was the famous Zimmerman telegram, the radiotelegram which brought America into the War on the side of England and her Allies.

As was usual with such messages, it was picked up by the listening stations on the East Coast, together with numerous other messages. At first glance there did not appear to be anything unusual about this message, just one of the many such telegrams coming in day and night.

"Another routine message from Zimmerman, Foreign Secretary to Bernstorff, German Ambassador in America," muttered the decoding officer with a shrug, as he wrote down the beginning of the telegram. "Most secret, for Your Excellency's personal information——"

HOW THE GERMAN PLANS WERE REVEALED

What was this? With an exclamation he summoned other experts.

"We intend to begin on the 1st of February unrestricted submarine warfare——" the telegram continued.

Of Supreme Importance

The excitement in the secret room of the Admiralty was now intense, for here was a message of supreme importance unfolding before their eyes:

"We shall endeavour in spite of this to keep the United States of America neutral. In the event of this not succeeding, we make Mexico a proposal of alliance on the following basis: make war together, make peace together, generous financial support and an understanding on our part that Mexico is to reconquer the lost territory in Texas, New Mexico and Arizona. The settlement in detail is left to you. You will inform the President (that is, President Carranza of Mexico) of the above most secretly as soon as the outbreak of war with the United States of America is certain and add the suggestion that he should, on his own initiative, invite Japan to immediate adherence and at the same time mediate between Japan and our-

The decoded telegram was handed to the American Ambassador, who straightway cabled it to the U.S.A. President.

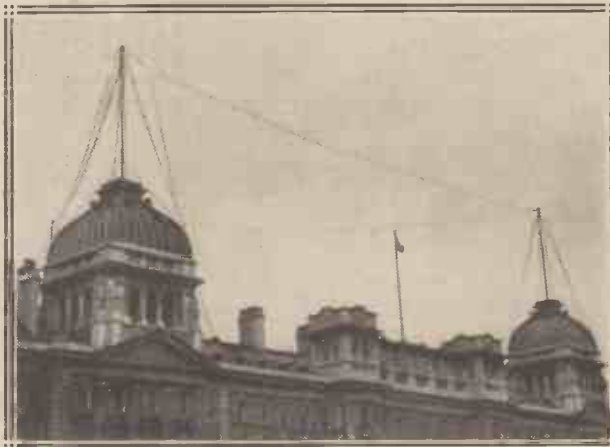
America could not imagine that Germany would be so foolish as to broadcast on the wireless a telegram so incriminating, it must be a forgery.

But proof was forthcoming of the authority of the message. There was no doubt about it, Germany was contemplating an alliance with Mexico against U.S.A. A month or so later America declared war on Germany, solely on the strength of an intercepted wireless message.

Intelligence wireless work in the War was greatly facilitated by the Germans' superior attitude towards all enemy secret services, particularly the British. The latter they regarded as an extremely childish effort, hardly worth attention by such experts in espionage as themselves. During the War they sent millions of telegrams on the wireless never dreaming that one and all were decoded by the English and, in many instances decoded more easily and reliably by the latter than by the German recipients themselves. In fact, the British Admiralty knew of the movements of practically all German craft immediately they had left German shores, when they left, where they were going, and how.

In the German mind the stupidity of the British was a byword, there was only one efficient secret service in the world, and that was German. It was this very attitude that enabled England to build up a secret service which left the German effort miles behind. Towards the end of the War the Germans began to suspect that all was not well in this best of all secret services, but by that time the war had been won—largely by the secret intelligence work of the Allies. Bitter must have been the German awakening.

WHERE RADIO MESSAGES WERE DECODED



Part of the Admiralty building, in London, showing the aerial system. During the war these were mainly used for work with the Fleet, most of the enemy interception being carried out at special listening stations along the East Coast.

selves. Please call the President's attention to the fact that ruthless employment of our submarines now offers the prospect of compelling England in a few months to make peace.

(Signed) ZIMMERMAN."

A German plot to bring Mexico into the War against America. It was the greatest secret service scoop of the War.

In All Parts

Secret service wireless was mixed up in all kinds of affairs and odd corners, East, West, South and North.

On the Bulgarian front, the pro-German Queen of Greece wirelessly secret information concerning General Serrail's forces at Salonika to the German Headquarters at Uskub. The pro-German Queen Mother of Spain wirelessly secret to the Vatican,

(Please turn to page 184)

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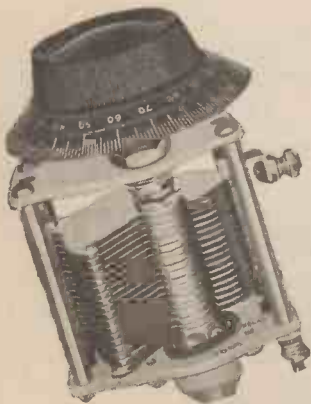
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SIMPLE SHORT-WAVE RECEPTION

Why not use your present broadcast receiver to pick up the numerous American and other short-wave programmes that abound throughout the world? The units described below are easily made and readily attached to practically any radio set.

ONE of the greatest boons to the home constructor who is interested in the reception of short-wave broadcasting is the heptode valve. It has solved the problem of easy reception, and has paved the way to a simple short-wave converter of the superhet type.

The two circuits on this page show a battery and a mains version of a heptode short-wave converter for use with existing battery or mains sets. The units can be made up in any

Naturally the mains unit must have its H.T. potentiometer resistances of the correct values, and these must be calculated from the data given in the valve makers' information slips. That is why I have labelled them A, B, and C, with D for the biasing resistance.

The grid resistances and condensers are inserted for the purpose of smoothing the oscillations, for without these components the valve is liable to squeal when tuned to the lower ends of the various wavebands covered by the coils.

These latter, by the way, may well be of the four-pin variety, such as the B.T.S. Kelsey S.W. coils, though in some instances if a lively valve is used the reaction turns may need to be reduced in number to prevent squealing on certain tuning points.

Resistance "D" in the mains circuit is about 200 ohms for the Cossor A.C. heptode, which I found particularly fine in action, but its value will be provided by the makers' slip in the valve box.

There are many points of practical interest in the use of the superhet converter of this variety which I should mention. One is that hand capacity, as long as a good earth is used, is completely absent, and another that the aerial tuning is remarkably flat, so that the oscillator tuning is pretty well all that has to be worried about.

The main set is switched over to long waves, of course, and the tuning dial is set to about 2000 metres, where it is left untouched except for any slight adjustment used for

tuning accurately any short-wave station that is not quite tuned in on the oscillator.

It does not matter, by the way, if the ordinary broadcast receiver with which the converter is used is of the superhet type, for the fact that the short-wave stations will be "double-supered" is an advantage rather than a drawback; it increases the sensitivity of the arrangement.

The Connections Required

Naturally, the aerial is taken off the broadcast receiver and transferred to the converter, but the earth is left on, and the earth of the unit is connected to the earth terminal of the set. The H.T. and L.T. supply to the converter can be obtained from that of the set, provided that the H.T. voltages on the heptode are correct. These, as indicated previously, are determined by means of the values of A, B and C in the case of the mains unit, and by suitable H.T. battery taps in the case of the battery converter.

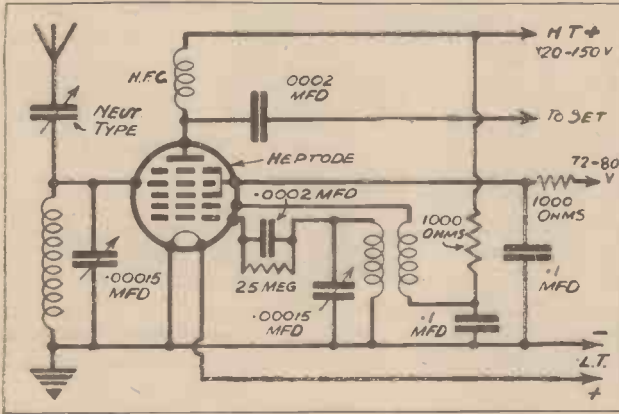
The final connection on the converter from the .0002-mfd. condenser to the set, is made to the aerial terminal of the receiver, and the neut-type condenser is set about three-quarters in for best results, as a rule.

Variation of this condenser is made to increase selectivity, or to increase sensitivity, according as to whether the capacity is decreased or increased.

One more practical detail, and I think you will be able to go straight ahead and make up your converter, if you wish. The H.F. choke in the anode circuit of the heptode is of the long-wave type, preferably of the superhet variety, for it has to deal with frequencies round about 150 kc.

K. D. R.

FOR BATTERY OPERATION



A battery heptode superhet converter circuit that will provide easy and efficient reception.

convenient form and attached to any radio receiver that has a stage or two of H.F. amplification.

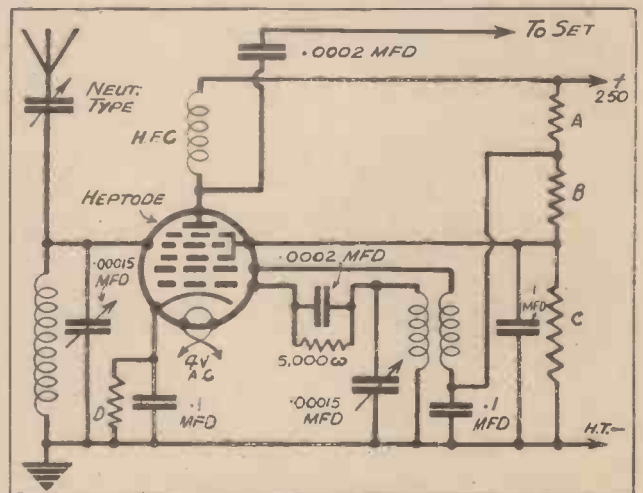
Reception of American short-wave broadcasters is remarkably easy with these devices, and as a matter of fact, although the aerial circuits of the units are shown tuned, they can be made aperiodic by means of short-wave H.F. chokes instead of coils, if desired, thus leaving the only tuning operation that of the oscillator grid coil.

Transatlantic Reception Easy

I have recently been using one of the circuits shown on my "Ferropower Five" (which I described a year ago), with an intermediate aperiodic H.F. stage, and nightly reception of the main S.W. transatlantic stations is a very easy matter.

The component values shown in the diagrams are those for Cossor battery or mains heptodes and may require slight alteration for valves of other makes, though if you try one of the circuits you will find that it is not critical in this respect.

AN ALL-MAINS VERSION



Where A.C. mains are available this circuit is recommended. The power can be taken from the ordinary broadcast receiver or from a separate power pack.

Using Your L.F. VALVES

by VICTOR KING

HOWEVER much sets may differ there is one section of any set which will conform more or less to standard. That is the L.F. "end."

So far as the H.F. circuits are concerned, there is practically nothing left in the modern receiver of the H.F. practices of ten years ago. But there are many sets, good ones, too, on the market whose L.F. stages differ but very slightly if at all from those of the pre-broadcasting era.

A Clearly Defined Task

Why should this be? I think the explanation is to be found in the fact that an L.F. amplifying valve has a more clearly defined task to accomplish and, moreover, deals with currents of a much less "temperamental nature" than does an H.F. valve.

But we must not neglect the L.F. stages, even if we do feel that their jobs are less tricky. They must not be left "to get on with it" simply because they do not protest against ill-usage in the many ways that do the pre-detector stages.

An H.F. circuit is concerned with selectivity, volume, stability and tone. The tendency is to think that an L.F. stage has to do with only loudness and tone. But bound up with "loudness" is the getting of programmes.

Don't Overload

Then, too, the tonal response of a set, which is very much concerned with its L.F. side, can affect selectivity. Alternately, the L.F. valve or valves can correct the tonal deficiencies caused by good selectivity.

So let us discuss the uses of L.F. valves on a broad perspective. In doing this, I think we may all of us make more of our sets.

The first important fact to remember is that the output of a set is limited by the last valve, the valve which feeds energy into the speaker.

It's no good at all building up

colossal amplification by means of first-class H.F. circuits and sensitive detectors if the output valve cannot take more than a certain small input, and can provide an output of a mere hundred or two milliwatts.

Are you making the most of your L.F. valves?—Although the L.F. sides of receivers have fundamentally altered but little in the last few years, great strides have been made in their uses and refinements. You will find much valuable information in this practical contribution.

You want a nice big power valve which can take all that the preceding valves can build up, and then some! That is, if you desire a volume proportional with great sensitivity.

If you don't, and you use a small power valve, then you must make sure that you don't overload it. Good volume controls early in the set generously operated ought to be employed.

to the close proximity of stations in the ether. Some stations even overlap to a greater or lesser extent, and you get little twitterings coming in from a programme in which you haven't the slightest interest. High-pitched twitterings and sometimes a high-pitched whistle.

Such interference can be cut out by means of tone control in the L.F. stages. The simplest form is a fixed condenser of, say, .01 mfd. connected across the primary winding of the L.F. transformer.

Desired Notes Also Go

But it must not be forgotten that some of the desired notes of the station you want to listen to will go west with the interference. You have to choose between a programme pruned of some high notes but free from interference, or of a better balanced reproduction having some interference accompanying it.

There is often a better result when a filter designed to eliminate only a certain small patch of frequencies is used. But such a scheme is valueless if the interference does not fall into a defined band of frequencies which can be dealt with in such a manner.

Unwanted Cut-off

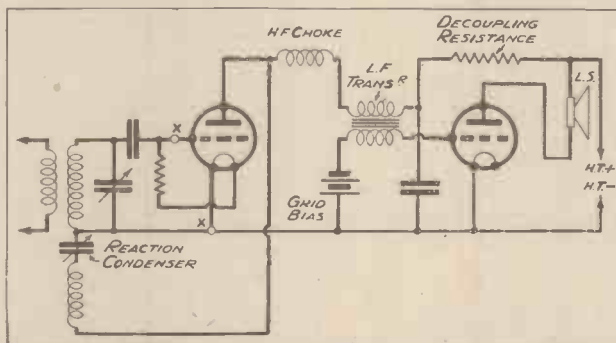
Actually, many L.F. circuits carry out quite a bit of interference elimination on their own, and without the assistance of filters, condensers and other such things.

Such circuits are, of course, inefficient if viewed as amplifiers pure and simple. Their response is definitely faulty. Perhaps it is the L.F. transformer which has a bad characteristic and deals rather poorly with the high notes.

Or it may be that the loudspeaker is doing the work.

The high-note twittering or squeal is not heard, or is heard only faintly, because the frequency or frequencies which it represents are not handled effectively by amplifier or speaker.

CONNECTING TO THE DETECTOR



The two points marked with an X in this diagram show where the input from a pick-up should be applied when the detector valve of a set is to be used as the first amplifier. Switching may be introduced to cut out radio reception.

That has settled one vital point. Henceforth we will all work within the limitations of our power valves—and also see that we don't overload earlier valves too, for just as much distortion can, of course, be caused by that.

Now for selectivity. Much of the annoying scraps of interference are due

Now this deficiency may be an advantage when there is that particular form of interference to be dealt with, but when it is not there obviously the station being listened to is not heard as well as it might be.

Inherent Tone Control

And, by the way, all the above applies to low frequencies, too. I mean there might be had smoothing in a mains set and a pre-disposition to a hundred-cycle hum.

If the amplifier and loudspeaker were very good, that hum might be annoyingly loud. But if the amplifier or speaker failed to handle the low notes well, you wouldn't hear the interference, or at least it might not be so loud as to constitute an annoyance.

Such inherent tone control, if I may so term it, is not to be applauded even if it does do good in certain cases. I think we should all aim at getting as "straight" an output as possible, and use additional and controllable tone control if we want to juggle with the frequencies for any reason.

I am greatly in favour of tone control. I don't think it is used half as much as it should be. I know tone controls appear on many sets, but in instances it is a rather half-baked form of control.

Cultivate a Musical Ear

A commonly employed scheme is to provide two-position tone controls. Either you get the high notes or you don't, sort of thing! That, in my opinion, is going less than half-way.

On the other hand, it may be argued that the average listener would not know what to do with proper and full range tone control even if he got it.

There is something to be said for that point of view, but not much in my humble view. I believe in giving the listener just a little more than he wants all the time. If he doesn't take full advantage of his opportunities, that is his affair.

So much for the listener and the factory-built set. The constructor is in a different class. He is supposed to know a good bit more about such things as tone control and its uses.

What are its uses? Well, I have dealt with one. That is the reduction of interference. But with a good tone control you can also build up those frequencies which have got pruned off

THE USES OF TONE CONTROL

by the selectivity of H.F. circuits or by the use of reaction.

Reaction is a great note killer. Half the "spectrum" goes west when you apply it for the purpose of tuning-in a distant station. It is then you particularly should use tone control to provide compensation for such losses.

Then with different makes of gramophone record you get a different treatment of the frequencies. Skilfully employed tone control will again enable you to even things out.

But to use tone control properly you want a musical ear and if you do

several purposes other than the amplification of radio signals.

An obvious and widely-known general use is the playing of gramophone records with a pick-up. It is a simple matter to add a pick-up to most sets.

Where there are two L.F. amplifying valves you may get enough volume by using only these. But generally it is advisable to recruit the detector valve as well.

Easily Connected

The connections are quite simple. The pick-up is joined across the grid and filament or cathode of the detector. The connection can be made by means of an adaptor which is freely obtainable. You pull out the detector valve, stick it in the adaptor and insert the adaptor into the detector valveholder.

Terminals are provided on the adaptor for joining up the pick-up. It must be remembered that the detector valve now becomes an L.F. amplifier, and a certain amount of grid bias is therefore desirable.

You can use the existing grid-bias battery for that. In two of my diagrams you will see how simple is the application of a pick-up. Of course, switching can be introduced.

Often, however, there is a tendency towards instability and this generally arises through a coupling effect between the output of the set and the wires used for connecting the pick-up. That is why shielded leads are frequently advised.

Another use for the L.F. valves is to employ a short-wave adaptor in connection with them, and so make a set suitable for the fascinating inter-continental listening.

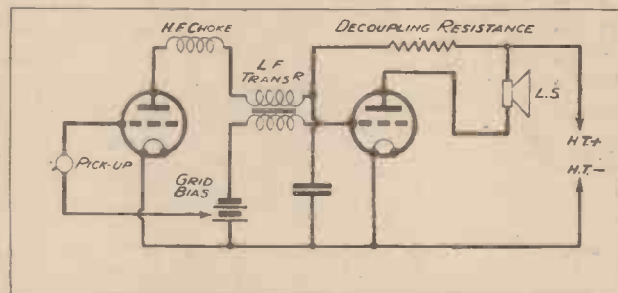
In the one form of short-wave adaptor, it is also possible to use the existing detector valve into the bargain.

Using a Microphone

Again, a microphone can be employed (the connections being similar to those for a pick-up), either for the purpose of making "spoof" announcements through the loudspeaker or, more usefully, to convey spoken messages to extension loudspeakers in other rooms.

I do this last in my own home, but the system suffers from the drawback that people at the extension speakers cannot talk back! Perhaps some ingenious reader of WIRELESS can devise a simple method for enabling this to be done.

A TWO-STAGE PICK-UP AMPLIFIER

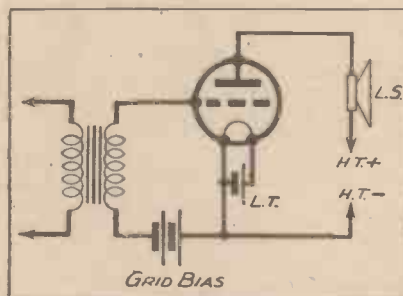


This circuit is an improvement on the one on the first page of this article, because the first valve is biased as well as the second. It may be used for other purposes than pick-up work.

not possess one naturally you will have to acquire it by experience.

So much for tone control. And I think I have really said enough about the general functioning of L.F. valves for the time being. If I pursue the matter further I shall find myself

FOR AN ADAPTOR



This single-valve amplifier is ideal for connecting direct to a short-wave adaptor to convert the adaptor into a complete receiver.

embarking on the troublesome seas of L.F. instability and so on.

But I don't want to do that, and so not leave space to discuss what I can term auxiliary employment for L.F. stages.

The L.F. valves of practically any set under the sun can be used for

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THE BIG THREE

News and views concerning recent happenings in the gramophone, radio, and film industries, whose entertainment sides are becoming more and more closely linked.

IT was inevitable that with the coming of the talkies, the gramophone, radio, and the cinema should become closely interwoven. And what an all-powerful trio in the world of entertainment the three branches form!

A senior, the gramophone has to be thanked for much of the talent we enjoy by wireless or on the screen. Many present broadcasting artists were household names before radio came along, popular throughout the country and the world by virtue of the now-considered crude disc and inefficient sound-box.

As the youngster of the trio, the talkies have the advantage that performers from gramophone or radio spheres can be picked, ready, with microphone technique, for appearance and hearing on the screen.

Henry Hall on the Screen

Bing Crosby, Kate Smith, Rudy Vallee, Jack Payne, and Roy Fox—all are radio artists who have been claimed by the screen in America or Britain. And now Henry Hall, is under a five figure contract to British International Pictures to make a film in which he will be the male lead and in which the B.B.C. dance orchestra will play a prominent part.

I understand the film is to be put over in a big way, and Henry will have plenty of opportunity to show his skill before the camera as he has with the microphone.

And why should not the public have a chance of seeing as well as hearing their radio idols, even though it be in a film story and not quite the same atmosphere that exists at Broadcasting House? Vision adds enormously to true realisation. So far television has not stepped in to assist our ears with vision, though in the next twelve months that lack may be remedied.

But when radio vision is an accomplished fact and we can see as well as hear many of our favourite artists, then we shall really feel the personalities of our entertainers; artists will become

living forces in our radio lives, not disembodied voices that may please one moment only to be whisked away into silence a second afterwards.

Now I am on the topic of radio vision let me say that I hope television will also give us—ere we grow too old—the chance to see some of the bands and crooners that supply our dance music after 10.30 p.m. Charlie Kunz and his new croonette, Girvan Dundas; Jack Jackson and Peggy Cochrane; Ambrose and Elsie Carlisle, and all the others.

Radio and modern dance bands have so firmly set the vocal refrain in position in almost every dance number that the position of crooner is becoming one of the most-sought-after jobs in the sphere of rhythm. But in spite of the fact that thousands of would-be



Fay Compton and Ivor Novello recording in the H.M.V. studios at St. John's Wood. A record by these two artists from "Murder in Mayfair" was published a short time ago.

vocalists besiege the dance band leaders every year, it is remarkable how many crooners and croonettes are found among the old stage families—in the persons of sons and daughters of old footlight favourites.

Last month I mentioned Annette Keith—a child star; now let me introduce to you Girvan Dundas, Charlie Kunz's recent acquisition—another child of the footlights, and almost baby performer.

Girvan Dundas is, I believe, only

twenty-five now, though she can claim twenty-two years experience in the show world! Girvan was in an act at three years, when she used to trot on the stage in her father's number on a request for a big strong man who was wanted to sing a chorus on the stage!

Very Versatile Artist

Since then she has been to Australia, where she played at a Melbourne theatre, and also wrote fashion articles for one of the newspapers. This latter came about, I believe, because Girvan won a competition for well-shaped legs—she was, in fact, known down yonder as Girvan "Legs" Dundas.

Incidentally, she is also a composer of no mean merit, and has had a hand in about two dozen songs. And yet, with all this full life Girvan has found time to get married and keep house. At seventeen she married Jack Barker, of the duettists, Walsh and Barker.

K.D.R.

LISTEN TO THESE

Some outstanding records from the latest lists.

VOCAL.

H.M. The King speaks to the Empire. The record of the Christmas 1934 broadcast from Sandringham. (H.M.V. RCS271.)

Peter Dawson. Sings "The Winding Road" and "The Man in the Street." As good as ever. (H.M.V. B3262.)

Bing Crosby. "The Very Thought of You" and "Let Me Call You Sweetheart." Bing Crosby needs no introduction to film and gramophone lovers. (Brunswick O1925.)

Danny Malone. Now recording for Decca; sings "There's a Cottage by the Shannon." (F5383.)

Layton and Johnstone. Turner Layton sings "June in January," and on the other side are the famous pair singing, "I'm Lonesome for You, Caroline." Last chorus is double recorded, giving a quartette between Layton and Johnstone and — Layton and Johnstone. (Columbia DB1485.)

INSTRUMENTAL.

Albert Sandler. Plays "Melody at Dusk" and "Daybreak." Always worth hearing. (Col. DB1480.)

Harry Jacobson. "Piano Medley in Dance Rhythm." A good, neat, lively record. (H.M.V. B8257.)

Quentin Maclean. Cinema organ version of the "1812" Overture. Fully recorded and an exceptionally fine piece of playing. (Col. DX654.)

ORCHESTRAL.

Boyd Neel String Orchestra. Two double-sided records contain the famous Holst "St. Paul's Suite." Originally written for orchestra at St. Paul's Girls' School, where Holst was music master. (Decca F5365-6.)

Marek Weber. Potpourri of "I Pagliacci"—a really good light orchestral record. (H.M.V. C2714.)

Philadelphia Symphony Orchestra. Playing Ravel's "Rhapsodie Espagnole." Two very fine discs. (H.M.V. DB2367-8.)

DANCE NUMBERS.

(Dance records of H.M.V., Columbia, and Red Label Brunswick are now 7/6.)

Jack Jackson. "That's the Way I Like to Hear You Talk," with "Dust on the Moon," the latter by Eddie Duchan and his orchestra. (H.M.V. BD102.) Also hear "On Ilk Moor," by Jack Jackson for a good comedy number. (H.M.V. BD101.)

Duke Ellington. For "hot" fans. "Sump'n Bout Rhythm." Typical Ellington recording. (Brunswick O1973.)

Ambrose. The number that was the subject of the B.B.C. ban, "The Pig Got Up and Slowly Walked Away." (Decca F5377.)

Johnnie Davis. Red label Brunswick. "You Gotta Give Credit to Love." (O1902.)

NOTES ON TELEVISION

—continued from page 164.

discs, one for the sound and one for the pictures, the two discs being rotated synchronously and started in phase.

There is an objection to the recording on discs, in that the frequencies required for high-definition television must be higher than those which suffice for good quality sound, and consequently the resulting picture is poor. There is the further obvious drawback that the duration or running-time of the disc is very much more limited than that of a film.

The Set of the Future

It would appear that the best method of recording television impulses is upon a film, in precisely the same way as for sound-on-film in cinema practice. A complete potted television scene with sound would then consist of two sound tracks on a film, one of these being the actual sound and the other being the television impulses capable of being converted by the television receiver into pictures.

All this concerns the actual technical process of recording, but the broader question is whether it is worth while to record television, whether on sound or film, as *television impulses*, or whether it is simpler and preferable to use an ordinary cinema type of film for the pictures. Those in favour of the former method claim that it involves much smaller films and takes up much less space. Furthermore, it means that we have in a single instrument a kind of "television radiogram" which will give us at any time, even in the absence of broadcast television, a potted television programme, just as an ordinary disc record will give us at any time a potted radio programme. I suppose the complete instrument of the future will be the combined radiogramophone-television and home-talking picture machine—unless anybody can think of anything else that can be packed into it!

High-definition Transmitters

An English Company which has been doing yeoman service is Scophony Limited, Dean Street, London, W.1. It has been making high-definition film television transmitters. One of the principal features of these transmitters is that they only require a very low power as compared with the arc lamps which are used in many existing types of transmitter. I understand that in the Scophony transmitter it is only necessary to use a 32-watt incandescent lamp.



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1 Graham Farish Litos condensers, .0005-mfd. and .0003-mfd. ...	4	0
1 B.T.S. anode coupler, .0001 diff. condenser ...	2	6
1 Polar diff. condenser, .0003-mfd. ...	3	0
1 Polar Compax .00075-mfd. condenser ...	2	9
1 Goltone pre-set condenser, .0005-mfd. ...	11	1
1 Ormond .0005-mfd. S.T.600 extractor cond. ...	3	0
1 Colvern S.T.600 extractor coil ...	8	6
4 Bulgin switches, types 8.38, 8.36, 8.22 and 8.80 ...	5	11
3 Benjamin 4-pin valve holders ...	2	6
1 W.B. horizontal valve holder ...	1	0
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1 B.T.S. reaction H.F. choke ...	2	6
1 T.M.C. Hydra .00035-mfd. condenser ...	6	6
1 Lissen .00005-mfd. condenser ...	1	6
1 Graham Farish .006-mfd. condenser ...	2	6
1 Dubilier 1-mfd. condenser, type 9200 ...	6	0
2 T.C.G. type 50 condensers, 2 and 1-mfd. ...	3	0
1 T.M.C. Hydra 2-mfd condenser (250-v.) ...	3	0
2 Ferranti G.H.I. resistances, 1-meg., 300,000 ohms ...	3	0
2 Eris 1-watt resistances, 1-meg., 25,000 ohms ...	2	0
2 Dubilier 1-watt resistances, 20,000, 75,000 ohms ...	2	0
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Described in December issue.

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EST. 1919

HARNESSING *the* ELECTRON

by **Dr. JOSEPH H. ROBERTS**

F. Inst. P.

ELECTRICAL engineering was born when Faraday discovered the laws of electro-magnetic induction; it was born again when J. J. Thomson discovered the electron and opened out a new and wider field of electrical theory and practice.

Faraday's work revolutionised the daily life of the whole of mankind, since the science of electrical engineering, with its multitudinous public and domestic services, is entirely built upon it. There was, in fact, a time—I suppose it was around the year 1900—when people said that everything had been discovered and there was nothing new under the sun.

About that time—1897, to be more exact—J. J. Thomson discovered, in his Cambridge Laboratory, that electricity was not a simple fluid, as had previously been supposed, but that it consisted of a multitude of minute particles—more like *sand* than *water*, to give a very crude illustration—and that, under certain conditions, these particles could be made to flow from one place to another without any metallic conductor to carry them.

At first all this—and there were, of course, many other interesting facts and discoveries brought forward at the same time—all this was regarded as of much theoretical interest, but totally unlikely to have the slightest effect upon anything that really mattered.

Most Important Discovery

The subsequent development of this discovery should be for ever a lesson to us never to jump to conclusions as to the value of a new scientific discovery. So far from Thomson's discovery being useless, it now ranks with Faraday's electro-magnetic discoveries in practical everyday importance.

I could give you almost innumerable examples of the practical uses and applications of electrons in everyday life, the first and most familiar to radio fans being, of course, the thermionic valve. The credit for this particular method of using electrons belongs to Fleming, and it is no doubt a fair statement of the case to say that the

whole of wireless telephony, including broadcasting, is based upon Fleming's invention, modified or elaborated, as it subsequently was, by Dr. Lee de Forest. Even if this were the only use to which the free electron had been harnessed, it would surely be sufficient

*The Free Electron, once the plaything of the theorists and experiment-
alists, has become the foundation stone of a new structure of electrical
engineering. It is entering more and more into devices and appliances
which affect our daily lives—wireless, television, electric lighting,
talking pictures. This article, based on the Tenth Faraday Lecture
given before the Institution of Electrical Engineers, affords you an
insight into the trend of modern developments and the ever-increasing
importance of the elusive "Free Electron."*

to give its discoverers a place amongst the immortals.

I will not devote further space to the valve, as its origin and development are familiar to all radio readers. I would like, however, to say something of the many other uses and applications of electrons, which are not, perhaps, so well known to you.

In the wireless valve the free electrons are obtained by liberating them from a metal wire or filament by raising the temperature of the latter to a sufficiently high degree. But there are other ways of liberating electrons from a metallic or other surface, and

NATURE'S FREE ELECTRONS



The most picturesque and awe inspiring indication of the presence of the free electron, in billions, is provided by Nature. Lightning denotes the passage of electrical energy in stupendous proportions. Here is a photograph of Nature's spark transmitter at work over a London suburb.

one way is by allowing *light* to fall on the surface—the latter being, of course, suitably prepared.

This is the principle of the *photo-electric cell*, which is the basic factor

in talking pictures and in television. In addition, photo-cells are now being applied to innumerable industrial purposes, and it has been said that this remarkable device enables nearly everything to be done automatically which man now does by virtue of what he sees.

Now let me turn to a different branch of electrical engineering, but an extremely important one, which is utilising the free electron in astounding ways in its development. Until a few years ago the electric lighting

engineer had little to work on but the electric filament lamp, in which the rapid passage of the electrons *within the filament* raises the latter to a luminous temperature.

It has now been found, however, that brilliant lighting effects can be obtained by making use of the *free* electrons that escape from the incandescent filament and causing these to pass at high speeds through different gases surrounding the filament. In this way "discharge lamps" have been made which give several times as much light, per unit of electricity consumed, as do filament lamps:

Everyone is familiar with the multi-coloured lighting of our streets at night—particularly the streets of London and other large cities. These effects may not be beautiful, but they are conspicuous and arresting, which is the intention. They are mostly "neon" lamps, in which the electrons are freed by brute force, as it were—in other words, by the application of plenty of high-tension voltage. These lamps usually produce about 1 candle of light per square inch.

Using Hot Electrodes

When *incandescent* electrodes are used, however, striking results are obtained. *Hot* material for the electrode provides such a wide-open door for the electrons that the flow is copious and takes place at relatively low voltages. The brightness of the column of light is also greatly enhanced, rising to as much as 10 candles per square inch. A hot-cathode luminous tube gives the same amount of light as a cold-cathode tube of ten to twenty

times its length. Units made with such lamps are in commercial use already, although their use is probably limited at present to colour flood-lighting and the like, where no alternative for obtaining coloured light is found to be so economical.

Experiments with such tubes have led to further important advances. Sodium vapour, for instance, has been used for carrying the discharge and forming the luminous gas-column, because the yellow light of sodium occurs in the part of the spectrum to which the human eye is most sensitive. Sodium vapour has been found to give a high percentage of light-radiation in relation to the amount of energy lost as heat.

Resisting the Hot Vapour

The sodium vapour has to be very hot indeed, however, and at these high temperatures it is corrosive. So research on special kinds of glass has been necessary, to find one that will resist the action of the hot sodium vapour. This has now been done and lamps have been made showing an efficiency 3 to 4 times that of our present filament lamps. The light from the sodium lamp is of such a pure yellow that at present we can think of its use only for such purposes as lighting arterial roads, where aesthetic considerations can be—or, at any rate, are—ignored. Under this light, objects appear in a monotone of yellow-brown.

If we use only sodium vapour in the lamp we can, of course, only expect to get the characteristic yellow light of sodium. But there are other vapours and gases we can use and each will emit its own characteristic hue when acted upon by the electron stream. Some are efficient, but of bad colour. Others give useful colours, but are inefficient, in that they consume too much electricity for the amount of light produced.

The Use of Mixtures

Attempts are now being made to use mixtures of gases and vapours, so as to build up the different colours and approximate to daylight (which is a composite light composed of all the colours of the rainbow).

There are difficulties in using mixtures of gases, however, for each requires its own conditions, and these have to be ascertained by research; materials appropriate to each have also to be found in the same way.

One of the latest types of lamp to be developed is the high-pressure mercury

vapour lamp; this has more than twice the efficiency of the filament lamp, so that a mercury lamp of this type of 400 watts gives the same amount of light as a filament lamp of 1,000 watts consumption. These lamps are beginning to be adopted in large numbers for street lighting.

The Tenth Faraday Lecture

Unfortunately I haven't the space to go on telling you of the many other ways in which the "free electron" is being utilised in present-day electrical engineering. I think I have said enough to whet your appetite, however,

and would refer you to the tenth Faraday Lecture, which was delivered before the Institution of Electrical Engineers by C. C. Paterson and published in the Journal of the I.E.E. The Faraday Lecture is delivered annually in honour of the founder of Electrical Engineering, and each succeeding year the Lecture serves to indicate the ever-broadening applications of electricity to our everyday life. As the lecturer said, in conclusion, "How Faraday himself would have loved to have given the lecture to-day! And what a lecture it would have been!"

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.....A SPECIAL ARTICLE BY ALAN HUNTER.....

THE B.B.C. GETS READY FOR TELEVISION

IN the catch phrase of the moment, "I'll be seeing you!" We may not have to look ahead so much in future. We shall just look in. Television really seems to be moving a bit.

Which is all the more reason why we should take a look at what the B.B.C. has been doing in preparation of the big onslaught on the production of television programmes.

Plenty of casual listeners, as distinct from the handful of "lookers," no doubt imagine that this television has just been sprung on the B.B.C. Not at all. On the contrary, a special department was set up way back in August, 1932.

Under a Television Producer, Eustace Robb to wit, the technique of actual television production—as distinct from the mirror drum and all that kind of thing—has been slowly but surely progressing.

So that, at the moment of writing, the B.B.C. has at its command a wealth of practical television production experience—upon which it will no doubt draw for future studio television transmissions.

It is worth while tracing through some of the television shows that have been put over by the B.B.C. since that memorable first programme on August 22, 1932.

As you can imagine, the production difficulties were enormous. No one knew anything about the type of make-up needed for the unique lighting of the darkened television studio.

Early Obstacles

There was very little money to spend. Very limited movements permissible—owing to inherent difficulties in merging close-ups with long shots.

Yet it was not long before the grotesque-looking make-up of the televised subjects was

During the past few years unceasing research in the technical and production aspects of television has been going on at Broadcasting House.

taken as a matter of course. Louie Freear was in that first programme, I remember, and so was Betty Bolton.

The next big event was something like a scoop. Amy and Jim Mollison came before the microphone—and the scanner. This was just after Mollison's wonderful East to West solo flight. He was re-united to Amy under the scanner, so to speak.

"Red Hot" News

That showed the enormous "news" possibilities of television. Jim, just back from America by boat, stepped right into the limelight—or rather twilight—of television. In the days to come, when celebrities of every kind are being flashed out by the television transmitters, we ought to remember some of these pioneers.

But, of course, we shall not. We shall be much too busy looking at the present. Just as the small but fervent band of lookers quickly passed on to

fresh excitements. To performing seals, ju-jitsu displays—and then, an adagio dancing act.

This was in October, 1932, when Vanda and Vladimir did an amount of slinging and flinging that must indeed have seemed wonderful to the lookers. A man in Huddersfield wrote in to say he had seen a fish being thrown to the seals—so the actual range of the first dancing act is incalculable.

Came another striking novelty, again showing the rich possibilities of the new medium. Nothing less than a television art show. Lord Lee of Fareham introduced literally thousands of pounds' worth of jade, silver and glass brought specially from Christie's.

Then, on October 26th, the first mannequin parade—another example of the endless possibilities of seeing by wireless. Here was something that ordinary sound broadcasting simply could not have attempted to handle. It pointed the way, this televised show, to the day when all the latest fashions will appear in every home equipped with a television receiver.

Already the technical side of the television service was rapidly developing. Long shots were successfully merged with close-ups, a vast improvement, and one that opened up possibilities that were very soon taken advantage of.

Clearer Pictures

The picture itself was cleaned up, too. Line distortion, quite a formidable obstacle at the beginning, was eliminated between Broadcasting House and Brookmans Park. This, taken with the curing of phase distortion, made an appreciable difference to the clarity of the transmitted picture, even though the actual number of lines, thirty, was, of course, just the same.

Increased power was developed by the photocells, the "eyes" of the

IN THE TRANSMITTING ROOM



The television scanner that was developed for use with the flying spot system at No. 16 Portland Place.

television transmitter, and this in turn led to improvements in the lighting of the subjects under the scanner.

An intriguing avenue of shadow effects was opened up. Silhouettes, high lights, floor shadows, distorted scenic shadows, the introduction of the artist by his shadow—all these effects were put over.

As I used to pop in and out of that tiny studio BB at Broadcasting House I was constantly amazed at the extra-



One of the early Baird televisions which were designed for the reception of 30 line television broadcasting such as that which the B.B.C. has been transmitting for the past two years or so.

ordinary effects they managed to produce with so little material.

Hardly a week passed without some new and fascinating vision act cropping up. How many of you remember, I wonder, the excitement when Carl Brisson was televised 600 miles to an audience of 3,000 in Copenhagen? He sang "It's Just a Bedtime Story."

Christmas, 1932. Santa Claus before the scanner, showing us all the new toys. What a Christmas Eve it will be when all the children of the land can look into such a scene!

The First "Panto"

With the dawn of 1933 came the first televised "panto," and a host of novel and essentially visual acts were booked in quick succession. The Lucerne Skaters, I remember. And Red Fred on his wonderful uni-cycle. Real television acts, these.

Mick the Miller made his bow in April, 1933—another intriguing possibility opened up, you see. What about televising the dog shows—imagine a wandering scanner going round Cruft's or Crystal Palace!

Coming events certainly did cast their shadows before the television scanner. For in that same April, which now seems so long ago, we had

the first television revue, with the Eight Step-Sisters, and a cast that included Anona Winn.

So it went on—world-famous dancers, animals from the zoo, every conceivable type of visual act was put over. About the middle of '33 came the introduction of the famous caption machine, which made a great difference to the throwing of captions, names of artists, even background scenes.

Two transmitters were used. One scanned the whole studio, the other the small card carrying the caption or miniature picture scene. At the receiving end, of course, it was impossible to tell which was which—both being reproduced in the same way.

Changing Scenes

Eventually a revolving drum was made, so that a dozen different scenes or captions might be arranged beforehand. That saved a lot of fiddling about—and added vastly to the flexibility of the productions.

Perhaps the biggest single development was the move of the whole of the television section from its tiny confined

space in studio BB—which had originally been designed for Henry Hall, you know—to much more spacious premises at No. 16, Portland Place.

Here it was able to fit up a separate control room for the television engineers, and to arrange the studio itself for more elaborate productions. The orchestral accompaniment was curtailed off. The back cloth was arranged on a roller. The whole changeover took about a week, and the first of the new studio programmes went out on February 26th, 1934.

Whatever the future holds in store for us in television productions—and it is a tremendously exciting future, at the lowest possible estimate—a very sound groundwork has been covered.

In the hands of the B.B.C. are already some invaluable secrets of television make-up, scenery, methods of "shooting," and requirements of colour balance in costumes.

Behind the B.B.C. in its plans to put television on the map lies a two-year period of experiment that ought to enable it to leap right ahead.

Other countries will be looking up to the B.B.C. while we are looking in.

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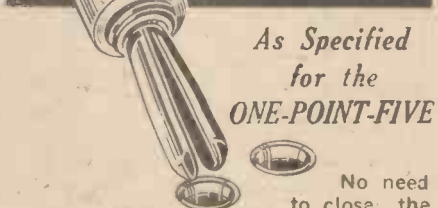
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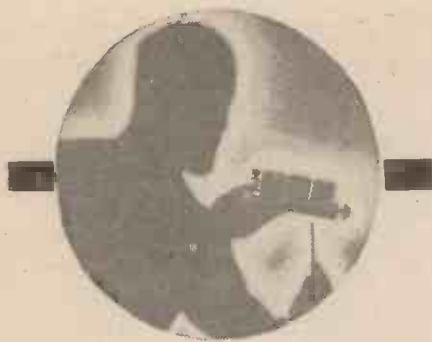
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WIRELESS IN THE GREAT WAR

—continued from page 172.

attempting to persuade the Pope to influence Roman Catholicism against France. Those great friends of Nurse Cavell, the Prince and Princess of Croy are said to have used a secret wireless to communicate with the famous nurse during her work in connection with escaping Allied soldiers.

Many were the rumours spread abroad of secret wireless stations, but while German spies undoubtedly received messages from such stations as Nauen in Germany, it is very doubtful if many secret wireless transmitters ever really existed except in the imagination of amateur spy catchers.

Messages to Spies

Referring to Nauen, on one occasion English operators were very much puzzled to hear a jumbled jibberish being radiated.

It sounded like high-speed Morse, but in those days high-speed Morse was rather beyond the ken of the wireless expert. After much brain fag someone thought of receiving these signals on a gramophone cylinder.

But on being played back on the gramophone the signals were still as puzzling as ever. Then, by chance, the gramophone motor ran down, and as it slowed so did the signals take on a sensible sound and become coherent. They were messages to spies in Spain and elsewhere.

No record of wireless in the Secret Service would be complete without the account of the part it played in the capture of the beautiful woman spy Mata Hari.

Before the War, Marguerite Zelle, or Mata Hari as she was generally called, became involved with the Crown Prince of Germany, and later left for Paris in the pay of the German Espionage Bureau.

Convinced Her Captors

In Paris she was watched, and later questioned, but somehow managed to convince her captors that she was not a German spy. In fact, she offered to become a French spy and suggested that she should be sent to German Headquarters at Stenay.

As it would have given the game away to the Germans if such a notorious woman were seen to be travelling straight from Paris and Holland to German Headquarters, she was sent via Spain and the sea to Holland.

On the voyage, however, the ship was examined by a British vessel, who reported by wireless to London that the notorious spy Mata Hari was aboard and what were they to do about it? Admiralty wirelessly back telling the ship to send her to Scotland Yard for examination.

Mata Hari was accordingly interviewed by Sir Basil Thomson—war-time head of the "Yard."

The beautiful woman confessed to Sir Basil that she was a spy for France, "not for Germany," she added. Eventually the Scotland Yard Chief persuaded her to give up spying and return to Spain.

A Wireless Trap

But soon she was short of money. How could she obtain some? Obviously the German Attaché in Madrid would pay her for the information she had obtained from the French in Paris.

Accordingly, on being approached by her the German Attaché sent a

THE EDITOR'S £5 PRIZE

The Editor wishes to take this opportunity of thanking the hundreds of readers of this magazine who have kindly written to him making suggestions for future gifts for insertion in this journal.

Many of the suggestions made to the Editor were very interesting, and after careful consideration of all letters sent to him he has decided to award the prize of £5 to Mr. V. E. Sparkes, of 13, Dault Road, London, S.W.18. Mr. Sparkes sent in several suggestions which, possibly in the future, may form the basis of another gift scheme for readers of this journal.

Wireless to German Headquarters asking for instructions re H.23, Mata Hari's code number in the German Espionage Bureau.

"Tell H.23 to report to a certain bank in Paris and collect five thousand francs," came back the reply over the wireless.

Promptly Mata Hari hurried to Paris, but alas! only to find herself immediately arrested.

The wireless message was a hoax, for the first message from the German Attaché in Madrid to German Headquarters had been intercepted and decoded by the French wireless stations and the message telling Mata Hari to visit Paris came, not from Germany, but from the French Secret Service headquarters. The spy had walked into a wireless trap.

But although she may have been lacking in morals, she certainly was not lacking in courage, for Mata Hari threw kisses and waved her gloves to the firing-party as she stood waiting that last and dreadful word of command—Fire.

**SOMETHING NEW
IN SPEAKERS**

RADIO in every room is an ideal that most listeners envisage at some time or other, but hitherto the practice cannot be said to have become universally popular because of (a) the expense involved, and (b) the difficulties of matching and the consequent risk of distortion in rooms remote from the one in which the original set and speaker are being used.

For absolute fidelity of reproduction, it is, of course, of the greatest importance that the impedance of the speaker, or of the transformer with which it is to be used, should match up with the output circuit of the set on which it is to provide an extension. And so many and varied are the types of output with which an extension speaker is likely to be used, that a speaker (or its transformer) with a definite and fixed impedance is of little or no use so far as the multitude is concerned.

A VERY ATTRACTIVE MODEL

It is to the credit of the Whiteley Electrical Radio Co., Ltd., not only that they should have foreseen this great difficulty, but that they should have taken such commendable steps to overcome it.

At the beginning of this month this enterprising firm released a new speaker—one of their famous "Stentorian" models—especially intended for extension use, and we have no hesitation in saying that in our opinion it is one of the most attractive lines that they have ever produced, and that is saying a lot!

To begin with, it is available at a price which brings it within the reach of all. That such a speaker should be offered in a walnut veneered cabinet for 29s. 6d. is conclusive proof of the tremendous popularity of W.B. speakers generally, for only in anticipation of a phenomenal demand could such an economical price be fixed. From past experience, we are fully aware of the excellence of W.B. speakers, and with one now available in cabinet form for less than 30s., the demand is bound to be colossal.

**THE NEW "STENTORIAN
BABY"**



This new "Stentorian Baby" speaker costs only 29s. 6d., complete with a walnut veneered cabinet.

Secondly, by a plug and socket system at the back, this new W.B. instrument can instantly be matched up to give completely satisfactory results with any set.

Without a doubt, it is just the very thing for extension use, and the fact that the cabinet is sensibly compact will appeal to all.

The speaker will handle any volume up to a maximum of 2 watts, but since it is one of the "Stentorian" models which are renowned for their remarkable sensitivity characteristics, there are few listeners who would have cause to use it "all out." As a matter of fact, this is one of few types of permanent magnet moving-coil speakers which will give perfect results with very small sets indeed.

FROM MY ARMCHAIR

—continued from page 167.

des frequences au delà de 5,000 périodes que dépend pour la plus grande part l'impression de naturel dans la reproduction de certains sons. Beaucoup d'instruments d'orchestre tels que le violon, la flûte, le tambour

There are three or four pages of this. Mind you, there's a lot to be said for this view. It has been graphically stated in a not dissimilar connection:

"Oggi nessuna persona che si interressi dell' evolversi delle scoperte, delle industrie e delle infinite loro possibilità può sentirsi tranquilla nell' ignorare i principi"

But not always. Sometimes it isn't.

Don't you fellows agree that *un raggio luminoso esplora con movimento eleioidale l'immagine trasparente che è avvolta su un cilindro?*

I'm not denying that *il ricevitore consiste in un galvanometro a corda sul quale è inviata la corrente raddrizzata provemiente.*

Or as the Zulus would say:

"Thagat agought tago gagive clagaphagam sagomethaging tago thagink agabagout."

* * *

Interest has not flagged in respect of Professor Eddy's* life story. And if it has, you're still going to hear more about him. But not to-day, as I have been busy with the "One-Point-Five" article.

Those Intimate Sidelights

Meanwhile there are a few rare volumes, probably only available at the British Museum, which give those intimate sidelights on a great figure which make him live again. The titles are:

- Eddy the Man.
- The Man Eddy.
- Man Eddy The.
- The Eddy Man.
- Man the Eddy.
- Eddy Man The.

A quaint story has been told me how in his later years at Göttingen, Professor Eddy ceased to examine his pupils in the conventional way. He had a parrot of which he was inordinately fond, and this parrot used to put students through a *viva voce* examination in physics. If dissatisfied with the answers the parrot would turn to the Professor and chortle: "No darn good, Prof."—and another man would lose his Ph.D.

J. S.-T.

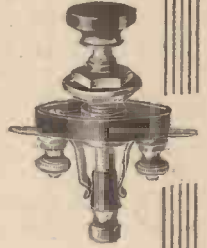
* A West Country newspaper described eddy currents: "So-called after their discoverer."

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To Success

THE EDITOR'S CHAT

—continued from page 143.

during the first experimental period at least, should be borne by the revenue from the existing 10s. licence fee.

The above is a brief summary of the major recommendations of the Committee.

Our readers will be interested to know that WIRELESS and our sister journal, "Popular Wireless," are the only radio journals mentioned in the list of witnesses who gave evidence before the Committee. No doubt, readers will remember that our scientific consultant, Dr. J. H. T. Roberts, gave evidence on our behalf before the Committee some months ago.

As we go to press Dr. Roberts is representing us at a Press Conference in the House of Commons, where the Postmaster-General, Sir Kingsley Wood, M.P., will preside and will answer questions put to him.

In our next issue we hope to devote greater space to this important Television development, and as usual to maintain our reputation of giving our readers the most authentic and detailed information about Television in all its aspects.

SHORT-WAVE NOTES

—continued from page 154.

Let us imagine that you have a whole day free (say March 1st), and are enough of a fan to want to spend it all at your short-wave receiver. How will you spin out the time? Here are my suggestions. Suppose we start at 7 a.m.

7 a.m.—Look for Melbourne, V K 3 L R, 31-metre band. Failing this, Australian amateurs on either 20 or 40 metres.

9 a.m.—20-metre amateur band should be interesting—still Australians and possibly South Americans.

10 a.m.—Very little doing. Shave and take the dog for a walk!

11.30 a.m.—Americans on 20 metres should be good, increasing in strength until 1 p.m., by which time Australians should be strong again.

2 p.m.—Possibly Bombay (V U B) on 31 metres, or Japanese stations on any of the broadcast bands.

3 p.m.—W 8 X K on either 14, 16 or 19 metres.

4 p.m.—19-metre band should be at its best with American broadcasts. This and the 20-metre amateur band should keep you busy.

6 p.m.—South African amateurs on 20 and possibly Australians on 40. Almost certainly Nairobi on 49. These three bands will occupy you until 9 p.m., when the 25 and 31-metre Americans should be good. These carry on till 11 p.m., when the

NEXT MONTH

The APRIL Issue of "WIRELESS" will include a further Special Contribution about

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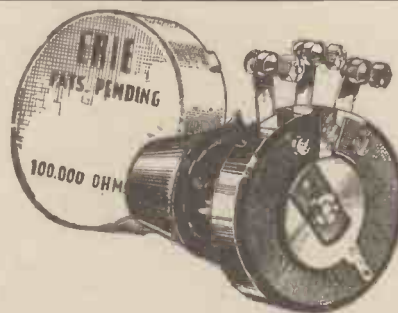
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49-metre band will be at its best, and will carry on till next morning.

If it's a Sunday, look for V K 2 M E on the 31-metre band about 6 or 7 a.m.

There's an example of fairly intelligent use of the short waves. If conditions have been reasonably good, you won't have wasted time on a "dead" band throughout the whole day.

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VICTOR KING'S PROBLEM

Our popular contributor has received a large number of entries in respect of his interesting contest. Will readers please note that no articles received by him after the 20th of February can be considered. The problem was described in the February issue of "Wireless".

this work; it will be the most fully illustrated work on railways ever published in this country. Each part will contain a large number of interesting photographs, in addition to many diagrams specially prepared by experts showing the construction and working of railway machinery from signals to locomotives.

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AN ALL-WAVE ALL-MAINS CIRCUIT

By A. S. CLARK

Details of an ambitious mains circuit for the experimenter which is based on a proved system of wave-changing for short, medium and long wave-bands.

Judging by letters we have received from readers who are experimentally inclined, there is a strong desire amongst them to build receivers of a universal nature. Not only do they like the idea of a set which will work on A.C. or D.C. mains, but they are also interested in making it operate on short waves as well as on the medium and long waves.

The Basic Scheme

Readers will remember that I described a set in the October 1934 number entitled "A Two-Valve All-Wave Receiver." This has proved to be quite a popular design, and since its publication I have had a number of letters asking for a more ambitious circuit on similar lines, but intended for mains operation.

In response to these letters I have drawn up the circuit on the next page. It is an H.F., det., and pentode arrangement drawn up on similar lines to the "Two-Valve All-Wave Receiver" so far as wave-changing is concerned, but intended for universal mains working. But right from the start I want to warn readers that it is only a basic circuit. That is to say, it is intended to indicate the lines on which

(Continued on next page.)



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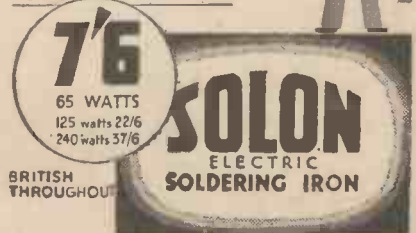
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AN ALL-WAVE ALL-MAINS CIRCUIT

(Continued from previous page.)

to build such a set, and is meant for those who have sufficient experience to design a practical layout from a circuit diagram.

Theoretically, the circuit should be perfectly satisfactory, but so much depends on the practical conception of a circuit of this type that modifications may be necessary. They will depend, for one thing, on the amount of screening employed, but will most likely be confined to the degree of decoupling required.

Variable Factors

This again, will depend to some extent on the particular valves employed. For this reason, no values are given for the decoupling components. Similarly, grid-bias resistances are not mentioned.

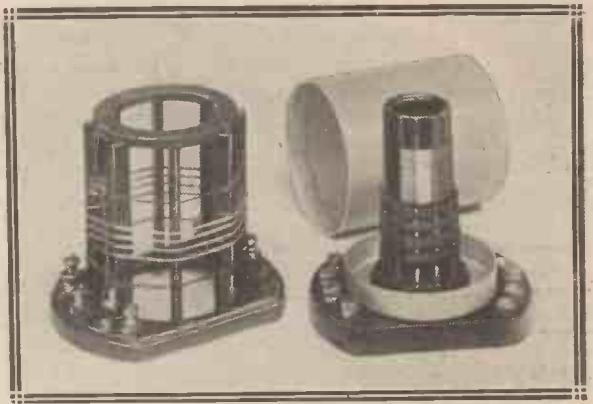
And now a word of guidance concerning the screening. I think the best idea is to use ordinary

screened tuning condensers, and to enclose the whole of the detector stage—valve, coils and all—in a complete screened compartment.

A similar compartment for the H.F. stage would not be amiss. The fixed condenser, shown dotted, might improve the volume of reception when working with the reaction condenser at zero on medium and long waves.

The coil system employed is identical with that of the "Two-Valve All-Wave Receiver," but two sets are utilised instead of one. In the case of the H.F. circuit the reaction windings are not needed, and are simply ignored.

The "broadcast" and short-wave coils are illustrated in the photograph at the top of this page. Details of the type of screened coil, and full



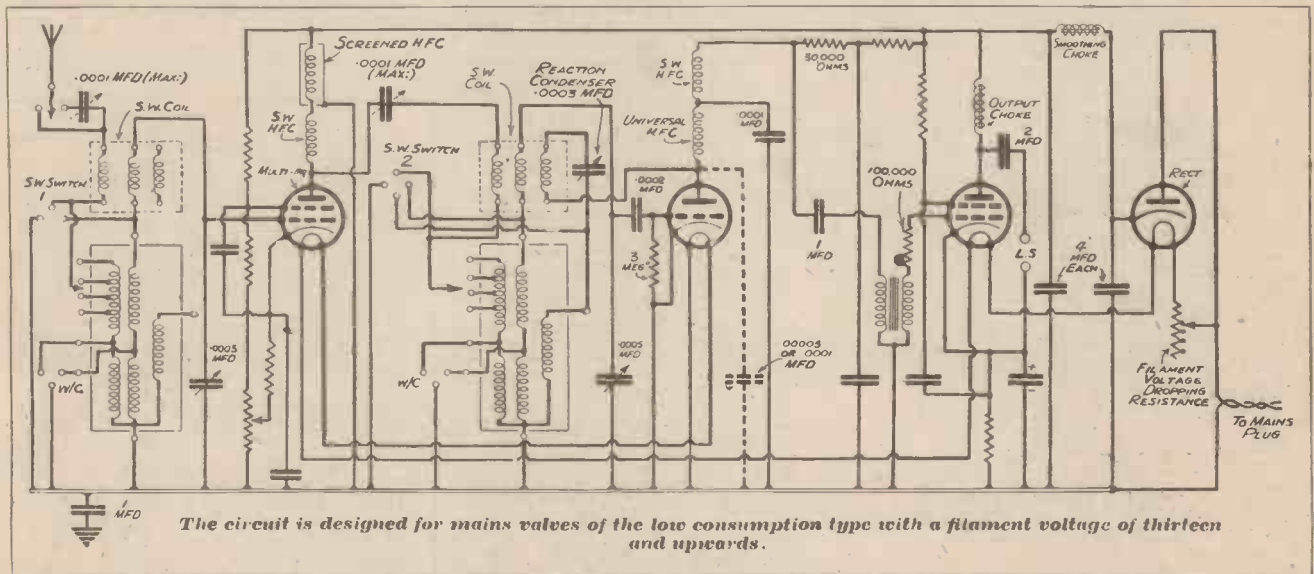
The short-wave and broadcast type coils that are employed.

constructional information for the short-wave one, are to be found in the October number already referred to.

A Point to Note

Just one final point. Use an insulating panel, and see that no metal parts of the controls, such as grub-screws, can come into contact with the fingers. There will then be no fear of shocks, which ever side of the mains is connected to earth.

NO COIL CHANGING IS NECESSARY



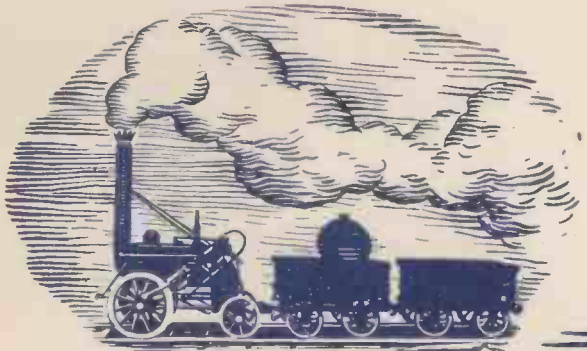
INDEX TO ADVERTISERS

	PAGE	PAGE	PAGE
Automatic Coil Winder and Electrical Equipment Co., Ltd.	141	Dubilier Condenser Co. (1925), Ltd.	Cover ii
Book of Practical Radio	173, 177	Henley's, W.T. Telegraph Works Co., Ltd.	187
British Television Supplies, Ltd.	183	High Vacuum Valve Co., Ltd.	181
Bulgin, A. F., & Co., Ltd.	185	Kay, W. B.	186
Colvern, Ltd.	184	Mappa-Mundi	Cover iv
Cossor, A. C., Ltd.	142	Marcus Overton Radio, Ltd.	187
		Lectro Lanx, Ltd.	183
		Peto-Scott Co., Ltd.	179
		Pickett Bros. (Cabinets)	186
		Radio Resistor Co., Ltd.	186
		Railway Wonders of the World	Cover iii
		Swift Service & Supply Co.	185
		Technological Institute of Great Britain	185
		Varley Products	169
		Ward & Goldstone, Ltd.	173
		Whiteley Electrical Radio Co., Ltd.	165
		Wingrove & Rogers, Ltd.	173
		Wright & Weaire, Ltd.	169

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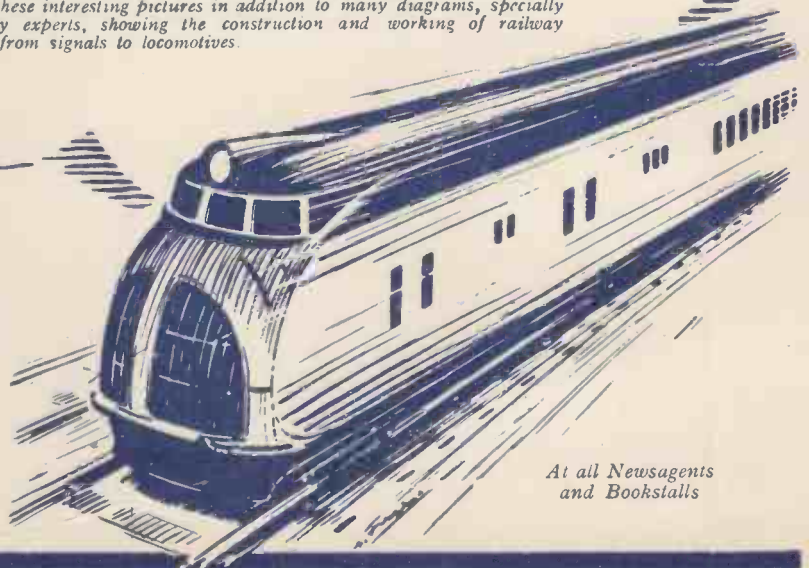
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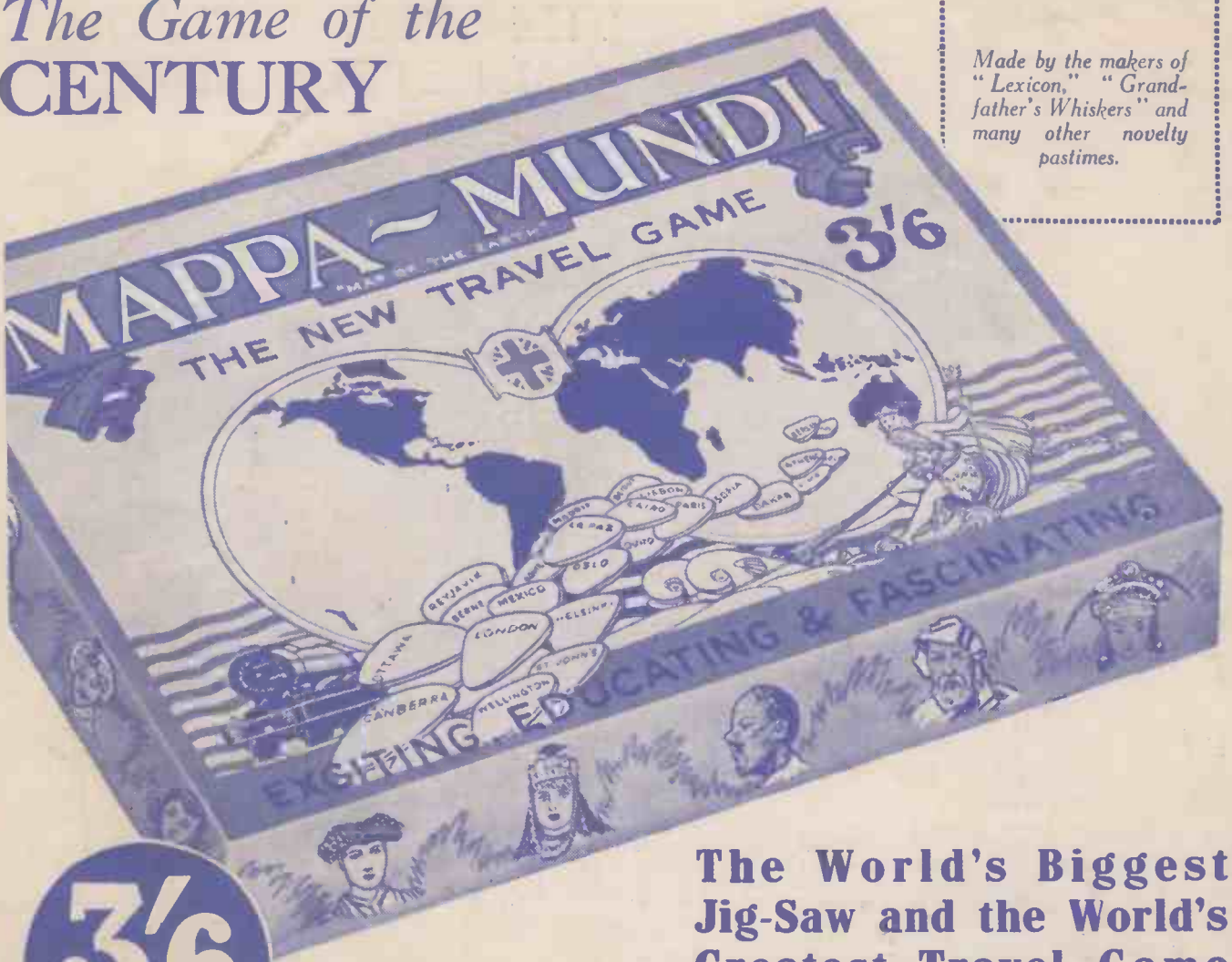
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