

ANOTHER STAR RECEIVER BY F. J. CAMM—1/- BLUEPRINT INSIDE

# Practical and Amateur Wireless



Edited by F. J. CAMM

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Publication

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March 21st, 1936.

AND PRACTICAL TELEVISION

**F. J. CAMM'S**  
**TUTOR**  
*Three*

*Learn as You Build!*

Practical & Amateur Wireless Blueprint No. 6  
J. Camm's  
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## EVERYMAN'S WIRELESS BOOK

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**200**  
Illustrations

By F. J. CAMM (Editor, "Practical and Amateur Wireless," etc.)

A Radio Consultant for the Listener, Expert and Amateur Constructor, explaining the Operation, Upkeep and Overhaul of all Types of Wireless Receivers, with Special Chapters on the Principles of Radio Telephony, Installation and Systematic Fault-finding.

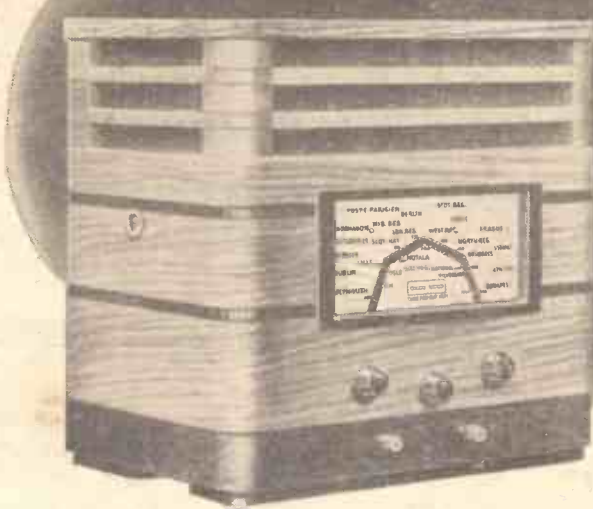
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Delayed automatic volume controlled super-heterodyne circuit with optional quiet tuning. Five Valves excluding detector. The Finger-Tip Programme Control Knob operates Station Selector Ray at touch of one finger. It moves a slit of light over scale calibrated in wavelengths and automatically illuminates a spot at the side of each station name.

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# Practical and Amateur Wireless

Edited by F. J. CAMM

Technical Staff:  
W. J. Delaney, H. J. Barton Chapple, Wh.Sch.,  
B.Sc., A.M.I.E.E., Frank Preston.

VOL. VIII. No. 183. March 21st, 1936.



## ROUND *the* WORLD of WIRELESS

### New French Stations of 1936

ACCORDING to an official statement, the Nice-Corsica and Toulouse-Muret high-power stations will be brought into operation next month. In addition, five more transmitters are to be put in hand. A new Poste National, 200 kilowatts, to replace Radio-Paris, is to be built on a site near Bourges in central France, and a 100-kilowatt station near Limoges, to work on the channel now used by Radio Toulouse (328.6 metres, 913 kc/s). The power of Bordeaux P.T.T. is to be increased to 100 kilowatts, and that of Rennes P.T.T. to 120 kilowatts. Two 100-kilowatt short-wave stations for regular broadcasts to the French colonies are to be installed at Montlucon, thus replacing the Pontoise installations; of these one at least should be working in the course of the present year.

### Further Proposed Growth of Czech Network

IN addition to the new 30-kilowatt Banska-Bystrica (Neusohl) station which is now ready to broadcast on 765 metres (392 kc/s), the Czech authorities are considering the installation of a further transmitter at Budejovice (pre-war maps: *Budweis*), the commercial centre of Southern Bohemia (Budejovice is situated roughly forty-seven miles to the North of Linz, Austria).

### Radio Jerusalem

IT is reported that although the Palestine station was actually used in the B.B.C. Christmas Radio World Tour, it has not yet taken up its daily duties. It is expected that the official inauguration of the transmitter will take place on Empire Day (April 23rd).

### Summer Time

SO far it has been arranged that Great Britain, France, and Belgium this year change over to summer time (one hour forward) on Sunday, April 19th. In France, however, there is a strong movement afoot to put the clocks forward on Easter Sunday (April 12th).

### A Mystery Station

REPORTS have been received to the effect that a powerful station has been heard testing with gramophone records on roughly 1,730 metres. So far no call has been heard. There is a strong possibility that this may be the new Moscow high-power transmitter so much talked about last year.

### P.T.T. Marseilles Realtor on the Air

ON 400.5 metres (749 kc/s) you may occasionally hear Marseilles, which has resumed its tests. Although it possesses the 100-kilowatt transmitter as an immediate neighbour, the two channels show sufficient separation to prevent interference.

### The Ampère Centenary

FRANCE has been celebrating, in particular at Lyons, the centenary of the death of André Marie Ampère, whose name was given to a unit of electric current.

Let THE  
"TUTOR"  
TEACH  
WHILE YOU  
BUILD!

\* \* \*

See page 3.

A further tribute to his genius will be made by special radio transmissions on the actual anniversary of his death, namely, June 10th.

### Radio Publicity in Europe

EVERY effort is being made to increase the sponsored concerts broadcast by Radio Toulouse (France), Radio Maroc (Rabat), and over the Spanish and Italian networks. A special office for dealing with American firms has been opened in New York. The sum of 1,390 dollars is charged for a fifteen-minute transmission through Milan, Genoa, Turin, Trieste, and Bolzano; only two half-minute announcements are allowed during the broadcast.

### More Identification Signals

THE Dublin and Cork studios are trying out a number of old Irish folk songs with a view to the selection of a musical interval signal. There are now so many on the air in Europe that listeners will soon have to wait for a station call to identify the transmission!

### Radio Marconi

THE new station which the Italians are erecting at Bologna, and to which is to be given the famous inventor's name, may turn out to be much more powerful than was originally proposed. It had been planned to install a 50-kilowatt station, but there is every likelihood of the transmitter possessing a much greater output.

### Argentine Now Four Hours Behind G.M.T.

SUMMER Time has ended in the Argentine Republic and the clocks have been put back one hour. Midnight in London is now 8 p.m. (20.00) in Buenos Aires.

### Lisburn Calling!

THE Northern Ireland 50-kilowatt transmitter, which will shortly take over the duties carried out by the old Belfast station, may now be heard testing on 307.1 metres (977 kc/s). Unless unforeseen circumstances arise it will retain this channel, which has been found favourable for the area to be covered.

### A Red Letter Day

WEDNESDAY, May 27th, is a date which will provide listeners with two star broadcasts, namely, the Derby and two or three transmissions from the R.M.S. *Queen Mary*, when she leaves Southampton for her maiden trip to New York.

### Those French Programmes

IF, during the course of an evening you turn to the French stations you will notice that on most days they are relaying an outside broadcast from Paris. Apparently some forty millions of francs are spent by the P.T.T. on programmes, and of this sum 75 per cent. is allotted to transmissions broadcast by Radio-Paris, Ecole Supérieure P.T.T., and Eiffel Tower. The Regional studios are complaining of this unfair treatment.

### A £20 Car You Can Make!

MOST of our readers will associate Mr. F. J. Camm's name chiefly with the design of wireless sets. His activities, however, are not confined to that sphere, for he has unique experience of the aircraft, motoring, and engineering fields. In this month's issue of *Practical Mechanics* (6d.) he describes the construction of a special three-wheeled car which he has designed, and which can be made for less than £20 by any amateur.



# ROUND the WORLD of WIRELESS (Contd.)

## Gershwin Concert

THE Northern "Révue Orchestra" will broadcast another of its "Swing Low Sweet Music" concerts on March 27th. This time it will be devoted to works of the American composer, George Gershwin, the soloist will be Stephen Wearing, the well-known Merseyside pianist.

## A Tango Programme

HARRY ENGLEMAN'S Quintet will give a representative programme of tangos by eight composers on March 22nd. With them will be Thomas O'Hara, well-known Birmingham piano-accordionist. Marjorie Astbury will be the solo violinist for the tango by Albeniz, arranged by Elman.

## Camp Fire on the Karroo

DURING the last few months listeners have enjoyed the broadcasts by the "Rocky Mountaineers," the Canadian concert party with the atmosphere of the prairie and the lumber camp. The "Rocky Mountaineers," who broadcast for the last time on March 4th, will be followed by a South African concert party whose programme will be entitled "Camp Fire on the Karroo." This concert party is inspired by the vast South African plains—the Karroo, relieved only by the low "kopjes." It is the atmosphere of the farms and camps inhabited by Dutch settlers and Cape coloured people which Josef Marais, himself born on the Karroo, will introduce to listeners. This broadcast will be given in the Regional programme on March 19th.

## "At the Langleys"

THE four Birmingham journalists who arrange the material for these monthly broadcasts have brought to the microphone many interesting Midland people and Midland visitors. The three regular artists are John Lang, Michael North, and Vera Ashe. This broadcast, which will be given in the Midland Regional programme on March 27th, is the last of the present series. That in February featured foreign visitors to the British Industries Fair.

## Philharmonic Society's Concert

THE fourth subscription concert of the Sixty-second Season will be given on March 20th by the Belfast Philharmonic Society in the Ulster Hall, the first part of which is to be broadcast. The Belfast Philharmonic Chorus and Orchestra will be conducted by E. Godfrey Brown and the guest conductor, Arthur Bliss. Arthur Bliss will conduct his own Suite from Film Music and also "Lie strewn the White Flocks," a Pastoral for chorus, mezzo-soprano solo, solo flute, drums, and string orchestra. The soloists will be Evelyn Gibb (mezzo-soprano), Mary Jarred (contralto), and Henry Dyson (flute).

## "Microphone Tour"

THE North's questing microphone visits Hull on March 25th, and the result will be a big "Microphone Tour," giving a composite picture of some of the many activities of that great city and port. Hull is, indeed, the third port in the country, and its imports, produce, and raw materials

## INTERESTING and TOPICAL PARAGRAPHS

are said to supply a third of the population of the United Kingdom. Electrical recordings will introduce listeners to some of

## THE NEW PYE RECEIVER



Will Hay, the popular comedian, and his new Pye receiver (T12) with "Travelight" tuning.

Hull's 140 industries, including seed-crushing and oil extraction, timber importing, and aircraft construction. The broadcast will also include visits to places of local interest such as the Hull Museum and Wilberforce House.

## B.B.C. Midland Orchestra

MOZART'S Parisian Symphony and Arensky's suite "Silhouettes" will be the chief works in a programme by the B.B.C. Midland Orchestra, conducted by Leslie Heward, on March 27th.

## Symphony Concert

PART of the Symphony Concert by the City of Birmingham Orchestra on March 26th will be heard from Birmingham Town Hall. Leslie Heward conducts. The chief work to be given is Schumann's Rhenish Symphony.

## "The House Next Door"

HAVING visited Nottingham, Birmingham, and Leamington for his series of talks, "The House Next Door," Moore Raymond now goes to Derby. The fictitious address chosen in that town is "235, Wriglash Street," and the talk will be given in the Midland Regional programme on March 20th.

## March Cocktail

IN this topical mixture, to be given in the Midland Regional programme on March 19th, Martyn Webster includes songs and numbers relating especially to the month of March. The artists are Dorothy Summers, Nita Valerie, Godfrey Baseley, Lee Fox, Hugh Morton, and two pianists, Jack Hill and Basil Hempseed. Later in the evening Jean Salder and his Serenaders, from the Midland Hotel, Birmingham, give a studio programme of dance music.

## Good Friday Concert

ON Good Friday evening, at 7.30 p.m., a concert consisting of excerpts from "Parsifal" will be given by the B.B.C. Symphony Orchestra, the Philharmonic Choir and soloists, in Queen's Hall, under the conductorship of Sir Henry J. Wood.

## Birmingham Philharmonic String Orchestra

THE orchestra, after having contributed regularly to the National programme, returns, on March 20th, to the Midland wavelength. Johan Hock conducts a programme which includes the Grieg suite, "In Holberg's Time," and a short work by a Birmingham composer—"Song of Evening," by J. D. Davis.

## Vienna Goes One Better

HAVING visited all countries in which broadcasting systems are soundly established, the Austrian authorities have planned a new Broadcasting House which, when opened at Vienna in the spring of 1937, will prove to be the most up-to-date and modern radio centre in Europe. The scheme brings all studios, the concert hall, theatre, variety, cabaret stages, and lecture rooms under one roof.

# SOLVE THIS!

## PROBLEM No. 183.

Young built a three valve A.C. mains receiver for which a Cossor PT41 output pentode was specified. Having a Mazda AC/Pen output pentode on hand, Young decided to use this as he noted that the amplification factor, optimum load, current consumption, and voltage requirements of the two valves are practically identical. Why couldn't Young obtain satisfactory reception? Three books will be awarded for the first three correct solutions opened. Address your letters to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 183 in the bottom left-hand corner, and must be posted to reach this office not later than the first post Monday, March 23rd, 1936.

## Solution to Problem No. 182.

The capacity of the coupling condenser used by Jeffries was too low, and therefore adequate selectivity could not be obtained. A condenser having a capacity of approximately .02 mfd. should have been used. The following three readers successfully solved Problem No. 181, and books are accordingly being forwarded to them:—  
G. W. Young, 8, Rose Crescent, Gallowfields, Richmond, Yorks.; L. D. Thomas, 3, School Terrace, Elwynpia, Rhondda, Glam.; R. A. Rippingale, 55, Sunbury Buildings, Bethnal Green, London, E.2.



# THE TUTOR THREE

*A Simple, Cheap, Easily-operated and Most Efficient Station-getter which, as its Name Implies, will Enable You to Learn as You Build*

WHEN I introduced my Monitor a few weeks ago I had in mind the beginner. The Monitor was intended as a simple receiver which anyone could build without previous experience, and yet which would function satisfactorily in spite of its low initial cost. It has been astonishingly successful, and very many thousands have been built and hundreds of them are still being built by what I may term the new generation of wireless constructors. The Monitor held perhaps no new delights for the experienced hand, and yet many of them have built it. I backed up publication of the details of the Monitor with a series of articles showing how it may be modified, adapted, and improved on the expanding book-case principle.

The Tutor is an extension of the programme which the Monitor introduced. It is a more ambitious receiver than the Monitor, and by virtue of the circuit arrangement will give even better results than the Monitor. I do not claim that it is as selective as a superhet, but it certainly lacks some of the disadvantages of the superhet, such as the need for trimming and careful matching of intermediate transformers.

If you know a great deal about a subject there is always the tendency to presume that everyone else knows just as much and to conclude that there is no such person as a beginner. We were all beginners once, however, and the home constructor has only the technical press to guide him on the right lines. Each year a new generation of wireless enthusiasts enters our ranks, and unless one is careful their interest can be stultified and extinguished by the publication of matter which is above their heads.

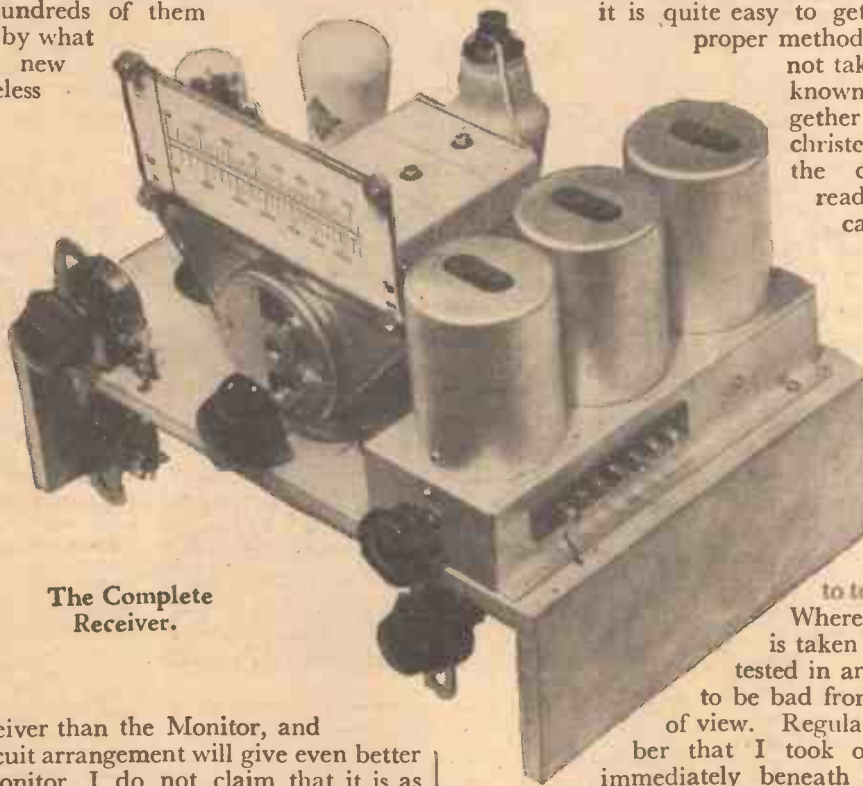
### Stringent Tests

And so the Tutor carries the beginner a stage farther than that at which he was left with the Monitor. With the enormous reputation for high quality which all PRACTICAL AND AMATEUR WIRELESS

*By F. J. Camm*

design of mine ever sees print until it has been through some gruelling tests; for I am a hard taskmaster, and it is my ambition that readers should obtain results immediately they switch the set on. And it is quite easy to get the design right if proper methods are adopted. I do not take hold of some well-known circuit, string together a few components, christen the set, and publish the details, leaving the reader to chance. I carefully select the components; I balance them, one against the other, modifying here, suggesting to manufacturers where improvements could be effected, altering a value there. The receiver is handed to several members of my staff to test and to report upon. Where necessary the receiver is taken outside London and tested in areas which are known to be bad from the reception point of view. Regular readers will remember that I took one of my receivers immediately beneath the aerial at Brookmans Park and slung up an aerial in order to test it. The same receiver was tested at distances of one mile between Brookmans Park and my office.

Under such exacting and rigorous tests it is easily understood why it is that in thousands of the homes of the British Isles, on the Continent, and in the remoter countries of the world receivers of PRACTICAL AND AMATEUR WIRELESS design provide the instruments for home entertainment. Nor can there be any surprise at the volume of correspondence which enters our offices expressing appreciation of the performance of our receivers. Here and there, of course, a reader strikes a difficulty out of which we are glad to help him, either by free advice, or, if necessary, by having the receiver to test and adjust. I make no charge for this service and cheerfully undertake it. You cannot establish confidence in a design in any other way, and I am certain that the Tutor will enhance the enviable reputation of this journal.

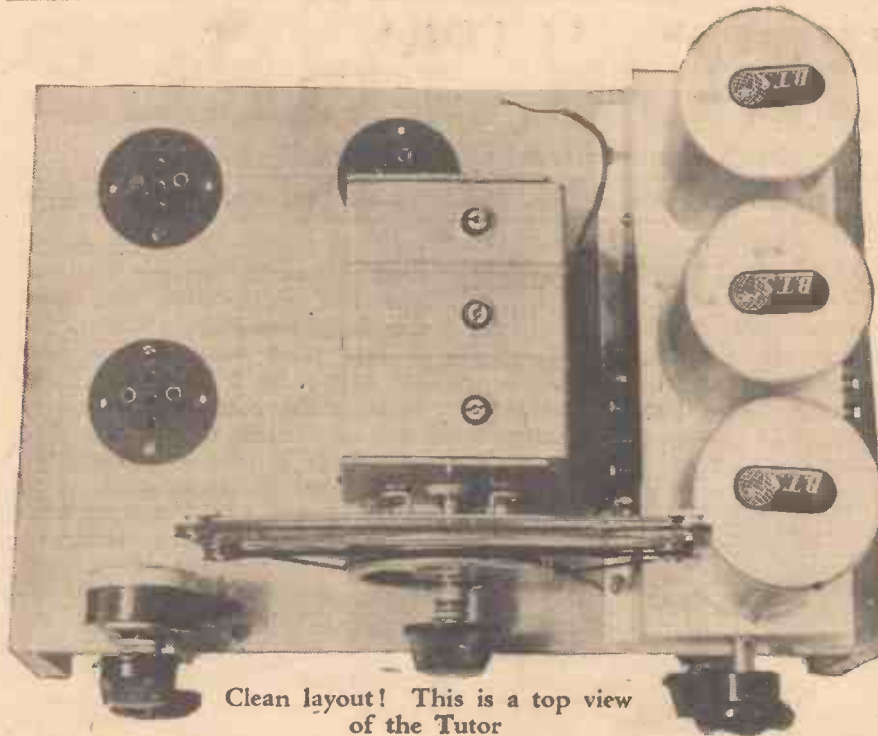


The Complete Receiver.

## World-Wide Confidence

Thousands of "Practical and Amateur Wireless" Receivers are in Operation Throughout the World. Receivers of Our Design are in Use Every Hour of Every Day in the Year!

# LEARN AS



Clean layout! This is a top view of the Tutor

## Construction

The constructional work may be undertaken by the novice with the utmost confidence, and the work will be greatly simplified if a chassis is obtained ready drilled. If this is done, then the only tools which will be needed are a screwdriver and pair of pliers, although soldering should be resorted to in certain places. However, even this may be dispensed with in an extreme case and connecting links employed. As will be seen from the Full Size Blueprint which is presented free in this issue, there are three large holes for the valve-holders, and if you are drilling your own chassis these should be cut with a lin. bit, and for the socket strips on the rear of the chassis separate  $\frac{3}{8}$  in. holes may be drilled to clear each socket, or slots may be cut to accommodate both sockets in each strip. An additional hole  $\frac{3}{8}$  in. or  $\frac{1}{2}$  in. in diameter may then be drilled at any convenient position on the rear

## Priced Component List

With the Tutor I have annotated for the first time, in response to many hundreds of requests from readers, the prices of all the components. This is a small service which I think they will appreciate. They can see exactly how much the receiver will cost them; they can strike out such items as they possess, and add up the cost of the balance. The Tutor may be used for short-wave reception, for which purpose a special short-wave converter has been designed, and a circuit, and list of parts (constructional details will be given next week) also with prices is included in this issue. The short-wave coil is of the replaceable type, so that any particular band may be covered.

runner through which the multi-battery cord may be passed.

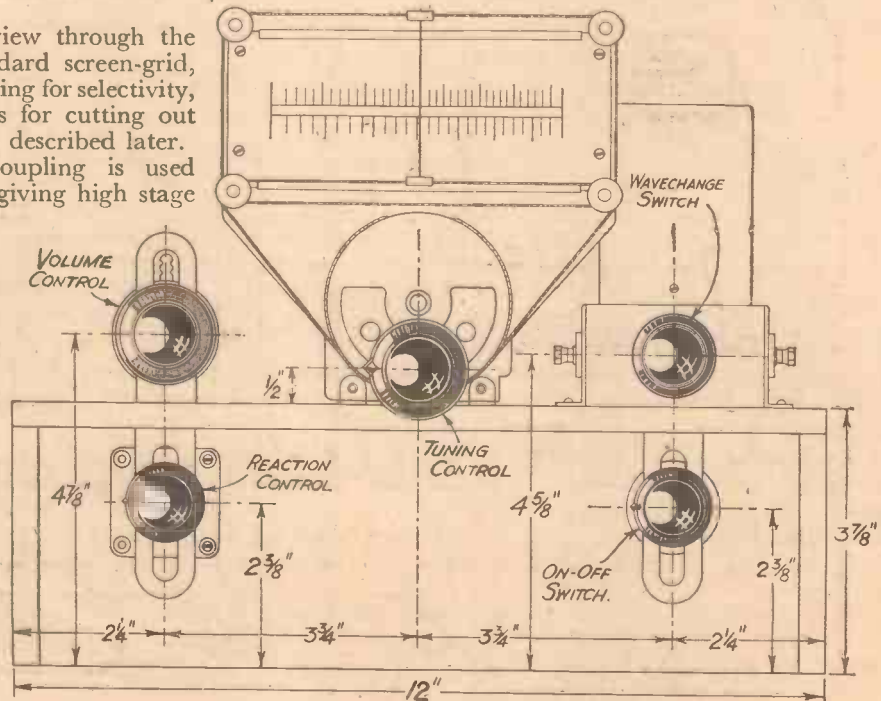
It will be seen from the Blueprint that there are also a number of small holes in the chassis through which the connecting wires are passed, and these are numbered on the blueprint from 1 to 8. These may be drilled with a  $\frac{1}{8}$  in. drill, and when making these holes an additional one may be drilled near the end terminal on the coil chassis, next to the group of terminals marked on the blueprint "Not used." It will be seen that the end terminal is not included in the bracket identifying these terminals, and it will be explained later how this extra terminal may be employed as an additional aerial connection. To facilitate wiring, the holes may be

## The Circuit

And now let us take a bird's-eye view through the circuit. It is seen to be of the standard screen-grid, detector, pentode type with bandpass tuning for selectivity, but incorporating special arrangements for cutting out the first coil for purposes which will be described later.

A parallel-fed H.F. transformer coupling is used between the H.F. and detector stages, giving high stage gain and stability of signal strength. Differential reaction with its enormous advantages is employed, and the low-frequency transformer is parallel fed, giving a mild degree of bass resonance partially to counteract the accentuated H.F. response of the pentode.

I have not considered it advisable to fit tone control, but it may be added if desired. I shall show how to do it later on. All that is required is the usual 10,000 ohms resistance in series with a .01 mfd. condenser shunted across the speaker. Note that the on-off switch is so connected that it breaks the grid-bias circuit and thus avoids discharge of the G.B. battery through the H.F. volume control.



Front of panel layout of the Tutor



# YOU BUILD WITH THE TUTOR!

numbered as on the blueprint on both the top and the under-side of the chassis, and then the valve-holders and socket strips may be screwed into position.

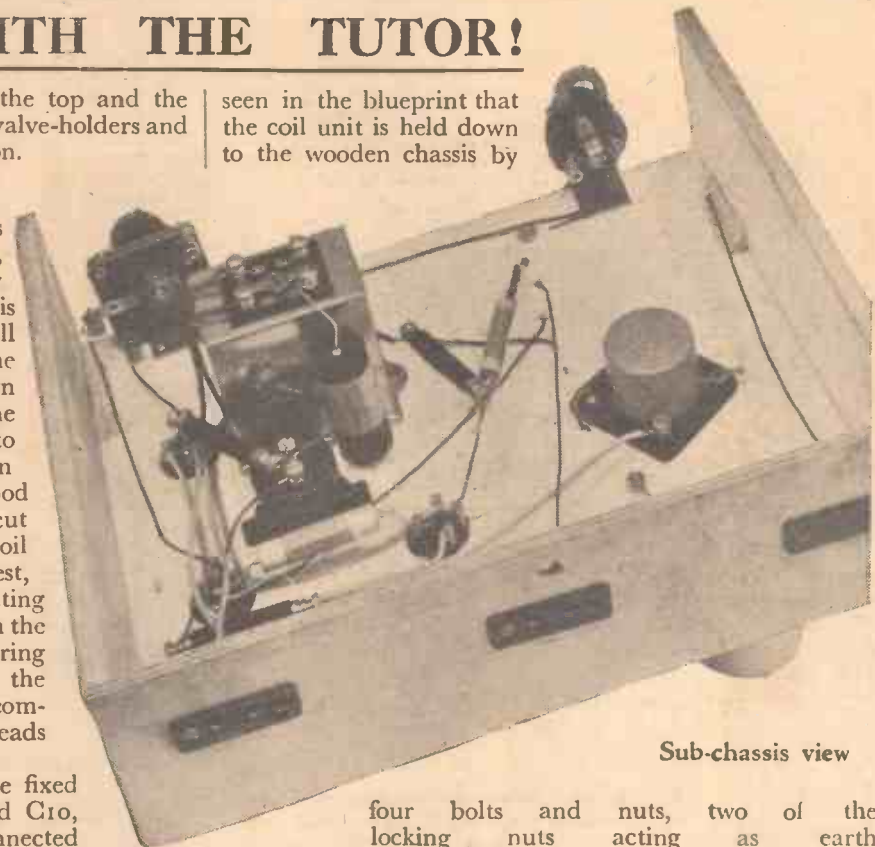
seen in the blueprint that the coil unit is held down to the wooden chassis by

## Wiring

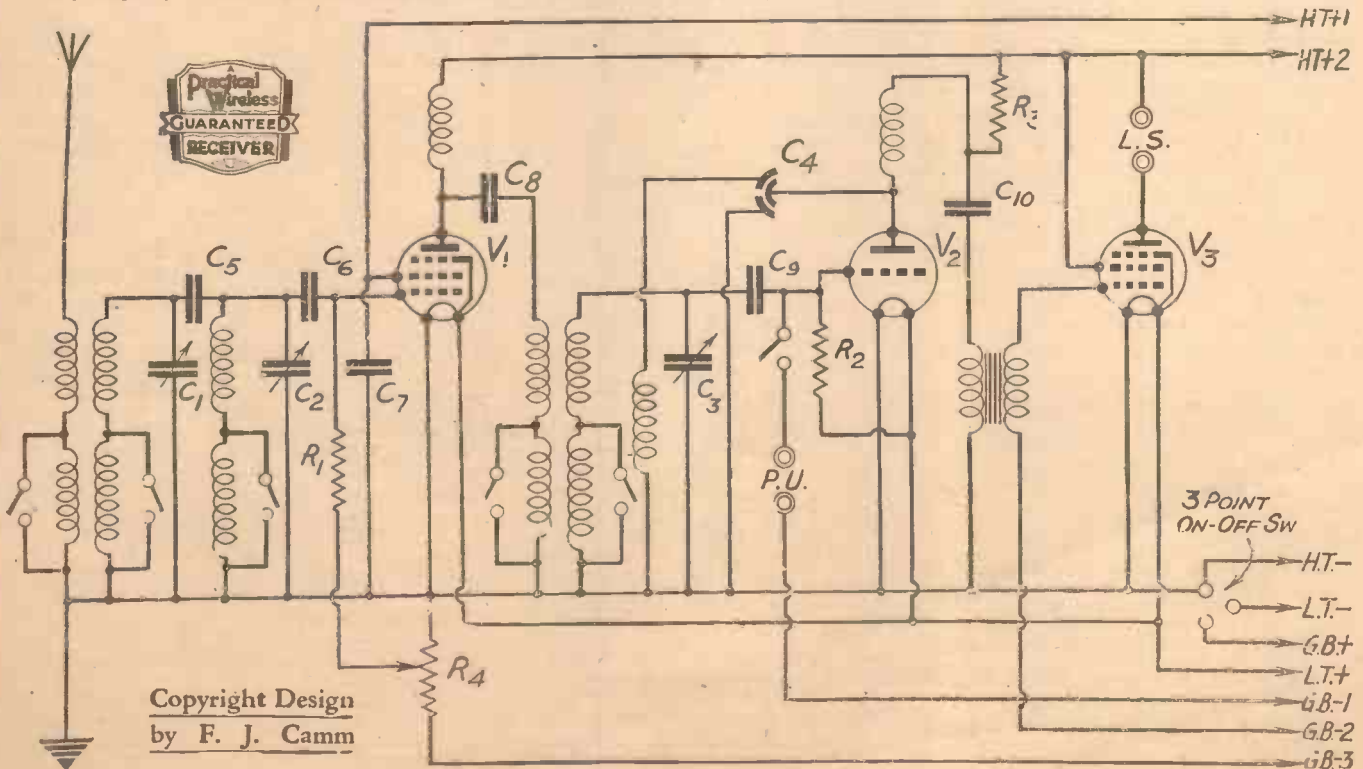
Each constructor has his own idea as to the best method of carrying out wiring, and there are several schemes which may be adopted. Firstly, the under-chassis components may be mounted, and all wiring on this side completed, whilst the chassis stands firm in an upside-down position. On the other hand, all the components may be mounted, and to enable the chassis to be stood firmly in any position side supports of scrap wood may be fitted to the side runners and cut to such a length that they clear the coil screens. The first method is the simplest, and by passing good long pieces of connecting wire through the appropriate holes when the under-side is wired the operation of wiring may be practically completed before the chassis is turned over and the upper components placed in position and the leads then joined to the respective terminals.

The wire ends which are fitted to the fixed condensers will, in the case of C7 and C10, enable these components to be connected direct to the valve-holder sockets and the H.F. choke and transformer. In the case of C6 an additional length of wire will have to be attached to one end to enable connection to be made, *via* hole No. 2, to the coil unit. The resistances will be supported by the connecting wires, and thus a fairly stout wire should be used for this purpose, as there is a moderate weight in the resistances and it is necessary to guard against short circuits which might arise owing to the resistances falling slightly when the chassis is reversed. It will be

four bolts and nuts, two of the locking nuts acting as earth return points (marked M.B.). An alternative scheme would be to employ ordinary wood screws to hold down the coil unit and to pass wires through additional holes in the chassis connected to the heads of the screws. The first method will prove more efficient, and it is a good plan to make quite certain that the surface of the metalised chassis and the flanges of the coil unit are perfectly clean before fitting the two together, and no difficulties will then arise at a later date due to poor contact.



Sub-chassis view



## These are Parts You Require for THE TUTOR !

	s.	d.	
One set "Tutor" coils on chassis ..	19	6	B.T.S.
One three-gang midget condenser (.0005 mfd. each section) (C1, C2, C3) ..	16	6	Polar
One V.P. horizontal drive ..	6	6	Polar
One .0003 mfd. differential reaction condenser (C4) ..	2	0	Graham Farish
Five fixed condensers :			
.0001 mfd. type M (C.9) ..	0	8	T.C.C.
.0003 mfd. type M (C.8) ..	0	8	
.002 mfd. tubular (C.6) ..	1	0	
.1 mfd. tubular (C.7) ..	1	4	
.5 mfd. tubular (C.10) ..	2	0	
Three fixed Ohmite resistances, 40,000 ohms, .5 megohms and 1 megohm (R.3, R.1, R.2) ..	4	6	Graham Farish
Two H.F. chokes :			
One type H.M.S. ..	2	6	Graham Farish
One Disc type ..	2	0	
One 50,000 ohm volume control, type VC.47 (R.4) ..	3	0	Bulgin

	s.	d.	
One Ace L.F. transformer (1-3) ..	4	6	Telsen
One three-point switch, type S.36 ..	1	6	Bulgin
Three socket strips, A.E., L.S., P.U. ..	2	3	Belling-Lee
Three chassis-type valve-holders : two 4-pin and one 5-pin ..	2	1	Clix
Three component-mounting brackets ..	1	0	Peto-Scott
Seven wander plugs : H.T.—, H.T.1, H.T.2, G.B.1, G.B.2, G.B.3, G.B.+ (Bowspring) ..	0	10½	Belling-Lee
Two spades, L.T.+ and L.T.— ..	0	4	Belling-Lee
One metallised chassis, 12in. by 8in. with 3¼in. runners ..	3	6	Peto-Scott

ACCESSORIES			
Three valves, 210VPT, 210Det, 220HPT ..	32	6	Cossor
One 120-volt H.T. battery—Drydex Super-life ..	10	6	Exide
One 9-volt G.B. battery, H1001 ..	0	10	Drydex
One 2-volt accumulator, DMG—C.2 ..	12	0	Exide
One Model 36S Stentorian loud-speaker ..	63	0	W.B.
One "Tutor" cabinet ..			Peto-Scott

### Precautionary Measures

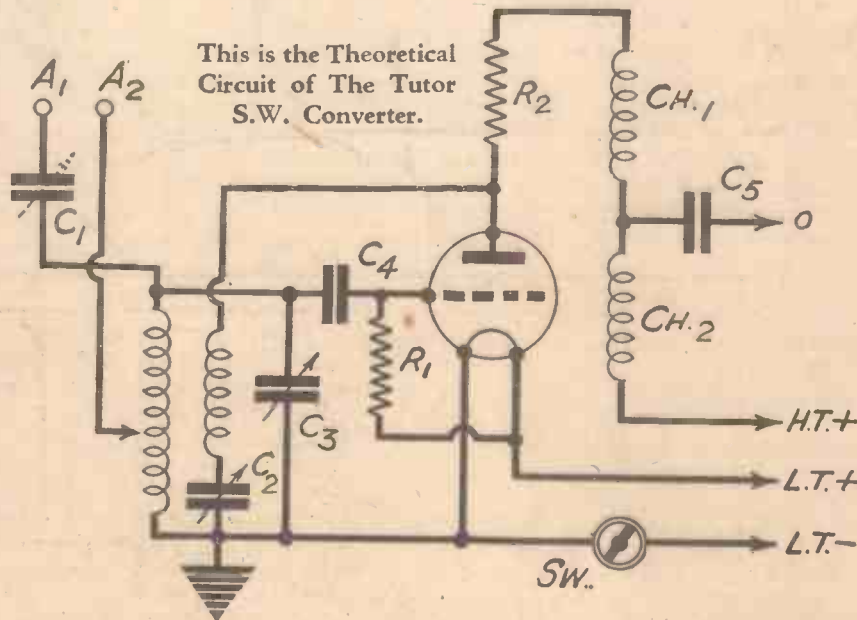
It will be noted that the on/off switch and the reaction condenser are mounted on component brackets screwed to the under side of the chassis, and this is of plain wood. Thus, there is no connection between the spindle of the switch or the moving vanes of the reaction condenser. Therefore, when mounting these two brackets very short screws should be employed (¼in. round-head No. 4 screws will be found ideal), and it will be seen on examination that if any longer screw is employed there is a risk of it protruding as far as the upper metallised surface and thereby connecting these two points together, with the result that the H.T. supply will be short-circuited through R3 and the H.F. choke. If the chassis is handled very much during constructional work there is a risk also of poor contact due to grease from the hands, and also a fracture of the metal surface. The coil unit is, however, connected direct to the earth terminal via one of the fixing bolts, but the condenser assembly normally obtains contact with the

rotors through the mounting feet. It will be seen that the precaution has been taken of connecting a wire from the front of the condenser chassis to one of the holding-down bolts on the coil unit, and in this way any possibility of trouble arising has been overcome, but it is necessary to make certain that the wire makes good clean contact with the coil unit side runner.

To prevent the battery leads from being pulled away from the various connecting points a piece of insulating tape may be wrapped round them on the inside of the chassis so as to form a large "knot" which will not

pull through the hole drilled in the rear of the chassis, but alternatively a small ebonite or wooden cleat may be cut and screwed across the rear strip. Do not be tempted to use a strip of metal for this purpose, as it may rub against the leads and cut through the insulation and thereby result in a short circuit.

**Operating**  
The operation of the receiver is extremely simple and will be dealt with fully next week.



## Parts Required for The Tutor S.W. Converter

	s.	d.	
One .00018 mfd. "Scientific" S.W. condenser (C.3) ..	7	6	Eddystone
One short-wave tuner, type SW.3 ..	4	6	Bulgin
One S.W. tuner holder, type SW.8 ..	1	6	Bulgin
Two tubular condensers, .0003 mfd. (C4, C5) ..	1	0	T.M.C.
One Air-dielectric fixed condenser (SW.77) (C1) ..	1	9	Bulgin
One .0002 mfd. slow-motion reaction condenser, type 957 (C2) ..	6	0	Eddystone
One 1,000-ohm one-watt resistance (R2) ..	1	0	Dubilier
One 3 megohm grid leak (R1) ..	1	0	Dubilier
One S.W. H.F. choke, type H.F.3 (Ch.1) ..	2	0	Bulgin

	s.	d.	
One screened Midget choke, type H.F.8 (Ch.2) ..	2	3	Bulgin
One Junior on/off switch, type S.38 ..	0	10½	Bulgin
One socket strip, type B ..	0	7	Clix
One 4-pin S.W. chassis-type valve-holder, type V5 ..	0	10	Clix
One Metaplex chassis, 8in. by 6in. with 2¼in. runners ..	2	9	Peto-Scott
One adjustable insulated bracket, No. 1007 ..	1	6	Eddystone
Two component-mounting brackets ..	0	8	Peto-Scott
One 210 Det. valve (metallised) ..	5	6	Cossor
Flex, wire, screws, crocodile clip.			





Fig. 1.—A typical Wadkin router, showing work specimens and jig. The cutter runs at the enormous speed of 24,000 revolutions per minute.

# Radio Cabinets in the Making

A Brief Description of the Improved Wood-working Machinery that Makes Good Moderately-priced Cabinets possible

## High-speed Cutters

The actual cutters are comparatively simple in design and are made of 18 per cent. tungsten high-speed steel; they are similar to a reamer in shape, and usually have one or two cutting edges. For grooving work a cutter having three edges like an end mill is used, while for hand hole work a special cutter which leaves a rounded edge is used. There are also a number of cutters for moulding and other ornamental work. The operator is aided by an automatic blower which keeps the work free from chips, and enables an unrestricted view of both cutter and work. Stopping is greatly speeded up (which in the case of a perfectly balanced spindle would waste a considerable amount of time per day), by means of an efficient spindle brake.

A cabinet front usually necessitates two operations: the fret which takes seven seconds, and the moulding which takes

(Continued overleaf)

THE machine-shop of a wood-working factory engaged on wireless work possesses a fascination which is largely due to beauty of product and the wonderful production speeds.

While the ordinary machine planers, bandsaws, and circular sawbenches are quite commonplace—other and newer machines play a more important part, but in this short article it is impossible to mention more than one or two of the most interesting. For instance, the modern high-speed circular sawbench can, when power fed, turn out certain classes of work at speeds of 130ft. per minute, and even greater.

## The Saw Plane

Other types of sawbenches fitted with special thin gauge saws called "The Novelty" and "Saw Plane," turn out sawn work with a smoothness and finish equal to the lower grades of planing, and quite suitable for many kinds of work without being run through a planing machine. In the one, the saw teeth run in series of five around the periphery of the saw, the first of each series being a larger clearing tooth, having a deeper gullet in front of it; in the other case the specially-shaped teeth are uniform around the blade. But most important of all in both saws the blades are hollow-ground, and run at an abnormally high speed for their size.

## The Electric High-speed Router

This machine is the most important one in keeping down prices, while ensuring the best work. The illustration, Fig. 1, shows one of these machines engaged on wireless work in the factory at Park Royal of Messrs. Gordon Russell, Ltd. To watch the operator is a revelation as he seems to achieve the impossible. A series of quick movements in which he moves the wood on the machine table backward, forward, and around, and in some few seconds, well under a quarter of a minute, an entire and perfect fret is completed. The secret is just this, underneath the blank wood (which usually covers it), is a metal jig shaped in a similar manner to the fret, and a pin or pins rise up from the table top; all the operator has to do, after starting

the cut, is to steer the jig around the pin. When finished, the fret is lifted off the jig, a fresh blank placed thereon, and an exact duplicate is produced in a similar period of time.

Naturally, certain other features of this routing machine are very important in order to enable the highest quality of work to be produced. For instance, the work must be able to be moved with absolute smoothness, particularly if the operator is not working with a repetition jig, but from a print pasted on the wood. This is done by having the table of the machine not only ground but also polished to a mirror-like finish. The cutter and cutter head must be of very high quality, on account of the almost incredibly high speed of 24,000 revolutions per minute at which they run.

To enable this almost incredibly high speed to be kept up, the head has an electric motor built directly on a micrometer ground nickel chrome spindle. It runs on ball bearings, specially selected and mounted in a way that takes up even the minutest amount of play or movement in the assembly. As any spindle whip would prevent good work, in this machine, a Wadkin, the spindle is amply supported by a bearing situated close up to the cutter. Further assurance of accurate work lies in the fact that all these machines have their head assemblies dynamically balanced on a special apparatus.



Fig. 2.—Cabinet frets by the thousand are produced in a fraction of the time taken by the old fretsawing method.



**RADIO CABINETS IN THE MAKING**  
(Continued from previous page)

twenty seconds, approximately. A finished cabinet front is shown in Fig. 3.

The illustration, Fig. 1, shows a Wadkin router with a compound table that enables it to carry out a greater variety of work, such as geometrical panelling, recessing, etc. The jig of the work seen in the photo is readily observable to the left of the operator's feet.

Moulding and planing can usually be carried out on all four sides of the work at once. In the past a very heavy, slow-speeded machine was used, run by a multitude of belts, and occupying a large amount of floor space. Now, a neat, all-electric machine, occupying a space of approximately 10ft. by 6ft., will carry out quicker and better work. The control of the machine has also been greatly improved.

**Press-button Control**

The self-contained electric cutter heads are stopped and started by press buttons,



Fig. 3.—A fretted cabinet front which was machined in under one minute.

conveniently grouped on a central panel, while for emergency stops a master button is duplicated at the opposite end of the machine. A large variety of planing and moulding work can be done on this machine, and outputs of from 20 to 100ft. per minute can easily be obtained, according to the kind of work desired.

Finishing operations are now much speeded up by means of compressed-air sprays, not strictly belonging to the cabinet shop, and automatic sanding machines of various ingenious designs, which ensure regular sanding on irregular shaped work. Finally, various power-driven buffs and polishing heads contribute their quota in enabling the modern cabinet factory to turn out good work at a price which in the old days would be thought impossible.

**A.C. AND D.C. MAINS**

Constructional Details of a Simple Rotary Converter are Given in this Short Article

**M**ANY constructors whose house mains are D.C. are faced with the problem of obtaining very much higher voltages than that available, and envy the ease with which those whose mains are A.C., can transform and rectify to suit any conditions. And the modern high-output valves are usually much more economically heated by low voltage A.C. than by D.C. mains with series resistances; so there is a considerable field for a simple form of converter, "running inverted."

A description of such a piece of apparatus, recently built, may assist constructors to make up small converter units from more easily acquired parts.

**Framework**

A base plate was made up as shown in Fig. 1. If welding be not a readily available process, the side plates may be strengthened and screwed on, tying across the tops. This base was drilled for brush-holder supports, slip-ring brush carriers, bearing brackets, and suitable terminal board.

**Slip Rings**

To avoid drilling through the end of the shaft for connections to be brought to the slip rings, it was decided to tap directly on the end faces of two commutator segments.

On account of the high speed of these small armatures, a perfectly balanced design must be used, and Fig. 2 shows how a very simple construction was obtained.

**Shaft Extension**

In this particular case, there was insufficient length of shaft for the slip rings, and an ex-

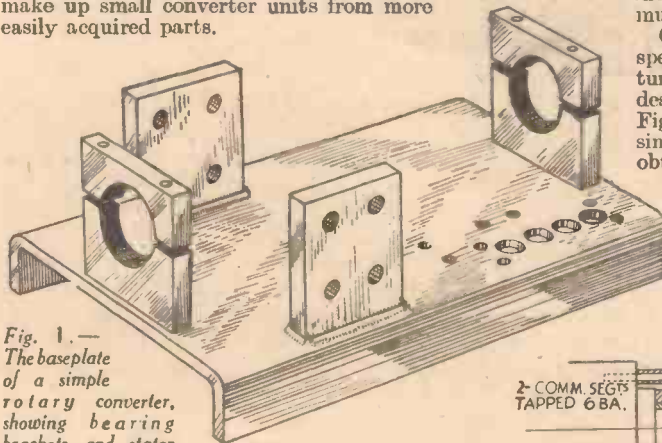


Fig. 1.—The baseplate of a simple rotary converter, showing bearing brackets, and stator mounting supports.

**Available Apparatus**

An armature and field system from a small "built-in" drive of a machine tool were available, together with the ball-bearings and brush holders. Either similar parts, or a secondhand motor of the correct voltage is not difficult to obtain cheaply, 1/2 h.p. being a suitable and standard rating.

Important points to note in obtaining the motor are:—

- (i) Even number of commutator segments, and
- (ii) Width of segments preferably not less than 3/16 in.

Fig. 2.—Showing how the slip rings are connected to the commutator segments.

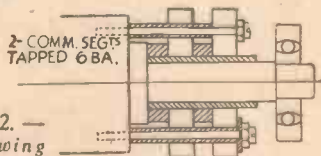


Fig. 3.—Method of mounting the field magnet between centring screws.

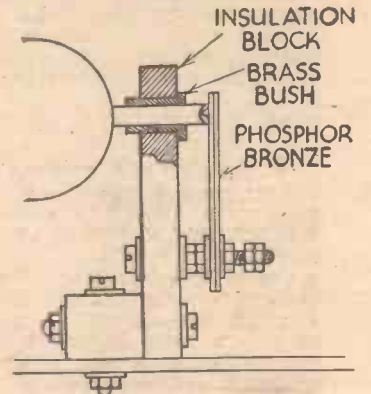
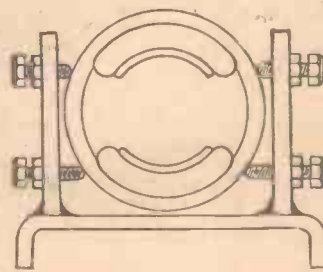


Fig. 4.—Details of the slip-ring brush.

tension was made. This was welded on, the commutator being wrapped in wet asbestos, and the extension then turned to the required diameter for slip ring mounting and the ball-bearing.

Fig. 4 shows the essential details of the slip-ring brush addition. The high peripheral speed of the rings calls for soft carbons which have a "lubricating" nature, and small pieces of soft graphitised carbon plate were cut out and turned. The spring pressure on the rings is varied by the number of phosphor bronze laminations, or by addition and removal of washers with the nuts on their fixing screws.

**Adjustments**

With the parts available, the best brush position relative to the field was not known, and to avoid a complicated brush-shifting device, the field system was made easily rotatable by slackening the centring screws. Fig. 3 shows how the stator mounting facilitated this operation.

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# Piezo Applications

**A**MONG the electrical phenomena which, not so many years ago, were considered merely as scientific curiosities, but have since been found applicable to numerous useful purposes, was the peculiar fact that certain natural crystals would generate electric voltages if mechanical pressure were applied to them in certain directions and, conversely, if they were subjected to electric pressures in certain directions, they would expand or contract. These phenomena were termed "piezo-electric" and, while when first discovered they seemed of little or no value, they now form the basis of many really important pieces of radio apparatus.

One of the first developed of these piezo applications was a means for producing oscillations of accurately maintained frequency for use in radio transmission.

## Maintained Oscillations

The principle of the crystal control of frequency is not difficult to understand. A quartz crystal, specially cut to have certain frequency characteristics, is employed. From what has already been said it will be clear that an alternating voltage applied to such a crystal will cause it to

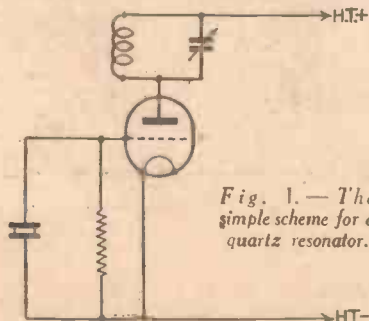


Fig. 1.—The simple scheme for a quartz resonator.

vibrate, and if the alternating voltage were continually applied, the "forced" vibration would be maintained at the frequency of the applied voltage. But a crystal of this type, having a certain degree of mechanical elasticity and inertia, will also have a natural period of vibration of its own, and if the frequency of the applied voltage is fairly close to the natural frequency of the crystal, the free mechanical vibration of the crystal will build up to a considerable amplitude and will, in turn, produce a correspondingly large oscillating voltage across the plates between which the crystal is clamped. This oscillating voltage can then be applied between the cathode and grid of a valve, and will maintain the oscillations produced in the valve and its associated circuits.

There are two main ways in which such crystal control may be applied. In the first place, the crystal may be connected in series with a coil in the grid circuit of a valve, and the first impulse given to it by means of a reaction coil in the anode circuit. Such an arrangement, shown in Fig. 1, is termed a resonator, but is not considered the best form of control since the frequency is slightly affected by the presence of the grid coil. Fig. 2 shows an improved system in which the only coupling between the anode and grid circuit is that existing via the anode-to-grid capacity of the valve. This arrangement forms a complete master oscillator. The amount of power which such a crystal oscillator can produce

is, of course, very small, and it is necessary to follow the oscillator by further amplifying valves. Moreover, it is not always possible to make crystals having natural frequencies equal to the frequencies at which it is desired to transmit, and in these cases a valve having a frequency which is a

## Data Concerning a Most Interesting Subject is Given in This Article

By H. J. Barton Chapple,  
B.Sc., A.M.I.E.E.

sub-multiple of the desired frequency is used, followed by one or more frequency-doubling stages.

## Sharp Tuning

It will be clear that a crystal of this type, having a natural frequency of its own, has certain properties in common with a tuned circuit and, in fact, since its mechanical damping is much less than the electrical damping of ordinary electrical tuned circuits, it is still more sharply tuned. A crystal can therefore be used in place of an ordinary tuned circuit for many applications where particular sharpness is desired, both as rejector or as acceptor circuits.

Crystals have, indeed, been employed in these ways in certain types of highly selective receivers, and are also now being used for controlling self-tuning receivers, more particularly that type of set in which the tuning condenser is rotated by an electric motor which is switched off as soon as a station is accurately tuned in. Crystals used in these ways are often referred to as "crystal gates."

There are, also, a number of other applications which are assuming more and more importance to the general listener, and these refer particularly to piezo effects at audio-frequencies.

## Amplifier Work

It so happens that crystals of a substance known as Rochelle salt are many hundred times as sensitive in their piezo-electric reactions than quartz and, moreover, they possess the very valuable property that the relation between the electric potential and the mechanical pressure is a direct or linear proportion, that is to say double the pressure produces double the voltage, or *vice versa*.

Those who have studied the question of amplifier design will know that perfectly linear response is essential to undistorted

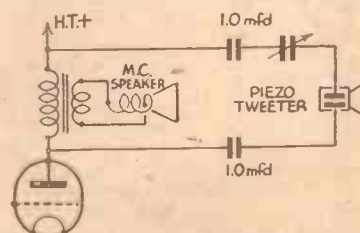


Fig. 3.—The simplest circuit for a crystal tweeter with tone control.

amplification, and although in this connection it is the linear response of one circuit with respect to changes in another circuit that is required, it is obvious, considering that the electrical transmission and reproduction of sound means the changing of mechanical pressures into electrical pressures and back again, that these properties of the Rochelle salt crystal might be of very great importance.

And, in point of fact, they are, for suitably designed Rochelle salt crystals form the basis of particularly high fidelity apparatus, including piezo-electric microphones and piezo-electric gramophone pick-ups. Similar crystal units are also used for loud-speakers of special type.

## Constructions

For microphones the crystals are cut to very thin plates only a few thousandths of an inch in thickness, and in many types two such plates are cemented together in order to render them sensitive to the pressure variations of speech and music, but insensitive to mechanical vibrations. For gramophone pick-ups, however, the two plates are cemented in a different way so as to render the combination sensitive to mechanical vibrations and not to pressure. A simi-

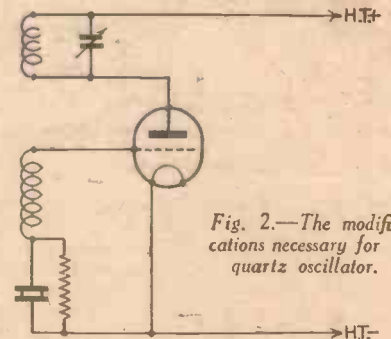


Fig. 2.—The modifications necessary for a quartz oscillator.

lar construction but, of course, on more powerful lines is required for loud-speakers.

For microphones and pick-ups, where it is required to generate an electrical pressure, the crystal is firmly secured, and the necessary connections are fitted at the points of support. For speakers, however, the plates, which are assembled as two-ply or four-ply units, are so secured that one corner is free, and the movement at this point is transmitted to the cone by a driving rod and an arrangement of levers.

The electrical characteristics of these piezo devices are particularly illuminating. For example, the response of a crystal microphone is substantially uniform at all frequencies up to about 6,000, and above that has a slightly rising characteristic. As the crystal arrangement acts, to all intents and purposes, as a condenser, any capacity due to the leads between the microphone and the amplifier will not affect the frequency response, but will only reduce the effective output.

An important point to note in connection with these microphones is that no volume control must be used between them and the first amplifying valve, or there will be a loss of low notes and one of the great advantages of this type of microphone, namely its level response, will be negated.

Piezo-electric pick-ups, by reason of their

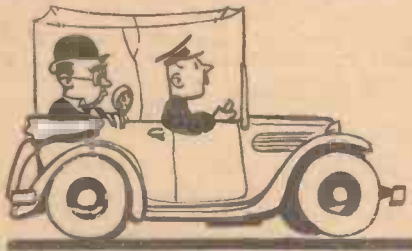
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# On Your Wavelength

## Radio on Cars

WHAT will the car of the future look like? I have read that attempts are being made to relay power which may be picked up and used to drive the automobile (I don't like motor-car) without the use of petrol and other obnoxious materials, and thus our streets will again be fit for heroes to breathe in. However, this is not the only thing, as the use of car-radio receivers also will no doubt lead to a re-designed shape for the car body in order to house the necessary aerial and preserve the acoustics for good reproduction. But, if it becomes general also to fit a transmitter, then what will happen to the car? I am reminded of this by an announcement that the well-known Mr. Henry Ford recently conversed with his manager in



Fitting wireless to my car.

Buenos Aires whilst he travelled in his own car in New York State. It is stated that his car was fitted with two aerials, and the power for both the transmitter and receiver was supplied by the engine of the car. I must try this when next I bring my car to town, for I am sure it must be very fascinating to sit back and in a loud voice curse the chauffeur whilst *soito voce* I curse some of those people who write me drivel about crooners and dance bands.

## Public Television-telephones

WE have been repeatedly told how television will aid in improving our standard of living in the future, but I can see some very big snags in this development. For instance, you can now go away from town and ring up your better half and tell her you are at the club. But what will happen when the telephone system incorporates also a television screen, and then when you ring up from a public call box or other place, the background will be seen behind your head and thus choke the lie in your throat? Or what about the added horror of being unable to get away from a much-hated acquaintance from whom you have borrowed a book or an umbrella and forgotten to give it back. I see that in Germany they have just opened a public telephone-television line where a resident in Berlin may, upon the payment of a sum equivalent to five shillings, talk to a friend or visitor to the Leipzig Fair and may see him at the same time. I remember the experiments some years ago in America on these lines, and it seems now to be coming nearer. But let us hope that it will not be general in my time, as I am sure that I shall be caught out.

By Jhermion

## Avoiding Offence

I COMMENTED some time ago on the way various listeners use their wireless set, and remarked on the way some people feel that they are actually entertaining the performers in their own home. But I had no idea that the feeling could be carried to such an extreme as in one case which I have just had brought to my notice. I was told that a certain old lady—who, just to be nice, shall be nameless—abhorred the talks which were sometimes given, and the person who recounted this episode said that they were present in the lady's home when just such a talk started. With a muttered "Excuse me," the lady rose to her feet, walked slowly to the receiver and, taking the volume control gently between finger and thumb, slowly turned the set off. When asked why such a deliberate performance was adopted, she explained that she did not like the talks, but did not like to hurt the speaker's feelings by rudely shutting off, and she felt that she was dealing courteously with the speaker by gradually extinguishing him. There is something in that, although, of course, the speaker has no indication as to how many or how few are listening. I sometimes think this is a good thing, because I imagine there are occasions when nearly every home is engaged in a mad scramble for the switch in order to turn off a speaker after the announcer has gravely announced that "there will now be a talk on the Damnation of Music."

## For the Children's Sake

WHAT constitutes a "broad mind"? Just lately there has been a lot of pother about the type of humour which is broadcast by some comedians, and we hear that certain people judge the jokes and humour by its suitability for the younger generation. This is quite a good idea, but how is one to tell, before the broadcast, whether or not the item will be suitable? At the cinema we have the A and U certificates, so that we can select a programme which will be suitable for our children, but we cannot suddenly in the middle of a programme turn round and say "Off to bed, Gerald," without explaining why. I understand that in France a system has been adopted by which the forthcoming item is clearly indicated, and so, if you understand French, and pick up a broadcast from the station in question, you will hear: "Mesdames, Mesdemoiselles, Messieurs," and will know instantly that the item is for general home consumption. But if the announcer merely says: "Mesdames, Messieurs," then you must at once get rid of the children whilst you enjoy the ensuing item or joke. But I cannot foresee the staid English announcer gravely announce: "Ladies, Young Girls, and Gentlemen," for somehow it doesn't sound right.

## Praise from the Navy

I AM going to buy a new hat! I have been told I deserve it, and by no less a person than a member of his Majesty's Navy, and this is what he said, writing from his ship "out Egypt way":

"Having read your articles for six years, I must say that to keep them as interesting as you do is real good going, and you have every excuse for wearing a size seven hat, and you have my permission to 'Cock-a-chock,' as the saying goes in the Navy. Yours are the first items I read each week, and they always come up to expectations. You have no severer critics than the naval 'sparkers,' who agree that what you write is worth reading. I think I have learnt more by your explanations than I have by years of gazing at diagrams. I thought it



Public Television boxes.

might interest you to learn how I came to be a reader of your articles. One evening, wandering round the ship, I was hard up for something to read, and all I got offered was a copy of PRACTICAL AND AMATEUR WIRELESS. I had never looked at wireless before, but thought it would do to pass the time away. 'On Your Wavelength' was the first thing I looked at, and when I had read it I thought: 'Here's a "cove" wot can teach and make this 'ere teaching interesting, and at the same time make yer larf'; so here's hoping we shall have long years of 'Thermy.'

"P.S.—I should like to have your opportunities to experiment on sets and the snags you get."

## The B.B.C. and Records

THAT there are two sides to every question cannot be denied, and last week I showed that a reader felt that gramophone records from the B.B.C. were the last word. Now I have received a letter from a Mr. Higham, of St. Helens, who puts the other side. He says: "Reading through your columns of this week, I was very surprised to see that a reader considers the quality of gramophone-record broadcasts to be superior to that of actual performances. In fact, these record programmes have for a long time provided me with my especial grouse! Although I realise that the B.B.C. pick-ups, etc., are really splendid, it is impossible to compare the quality of a recorded programme with that of a Queen's Hall relay or a studio symphony concert. I can only conclude that your correspondent must be using a set of the type which is so popular to-day—a small, ultra-selective,

(Continued overleaf)



(Continued from previous page)

multi-station affair, in which case the absence of anything like real treble and natural bass, and the accentuation of the middle register, will no doubt produce an illusion of purity and fullness of tone. If this reader could have the use of a high-fidelity outfit such as you described in a previous article, I am sure he would soon change his views. Even with my own set, which is quite a simple affair, designed with a view to local-station quality, reception and wide frequency-band preservation, I find no difficulty in recognising record programmes. The most obvious defect in gramophone records is the unavoidable distortion and attenuation of high-frequencies, and consequently, with a receiver and speaker combination capable of an appreciable output above 10,000 cycles, unpleasant effects are noticed. In fact, even the various makes of records have their idiosyncrasies in this respect, and with practice could probably be recognised and distinguished from one another. I have certainly noticed that American recordings are decidedly inferior to British, but for what reason I cannot attempt to say!

"In conclusion, may I heartily endorse your views on trios, etc., and their 'lukewarm' music. In my opinion, it is this type of programme that encourages the use of 'limited-frequency' sets." So there, all you quality fans, now what can you say?

#### New Transmitter for Northern Ireland

AN important event in the history of broadcasting in Northern Ireland takes place this week. Twelve years ago—to be exact, in October, 1924—His Grace the Governor of Northern Ireland, the Duke of Abercorn, declared open 2BE, the first B.B.C. transmitter in Northern Ireland. It was a happy ceremony; it was a humble beginning; the B.B.C. staff was very small



Turning off slowly so as to avoid offence.

and the apparatus in comparison with that of to-day was somewhat elementary. On March 20th, the Duke of Abercorn will open the new transmitter at Lisburn. In the short span of twelve years broadcasting has grown almost out of recognition. The new transmitter is the last word in technical and scientific efficiency; it is one of the most up-to-date of its type in the whole of Europe, and it will bring Northern Ireland programmes within the reach of many.

#### Symphony Orchestra's Continental Tour

THE B.B.C. Symphony Orchestra, under Dr. Adrian Boult, will leave England on a Continental tour on April 19. The first concert will be given in Paris, at the Salle Pleyel on Monday, April 20th; the following evening the Orchestra is due to appear in Zürich, where it will play at the Tonhalle; on Thursday, April 23rd, it will give a concert in Vienna, at the Konzerthaus; and on Friday, April 24th, it will



## Notes from the Nest Bench

### Pick-up Connection

IF the receiver is fitted with a good low-frequency amplifier, very satisfactory reproduction of gramophone records can be obtained provided that a suitable pick-up is used. It is advisable to have two valves between the pick-up and the speaker, although reasonably good results can be obtained from one valve if this is of the high-efficiency output pentode type. In the popular receiver of the H.F., detector, pentode type, however, the pick-up should be fed into the detector grid circuit. When battery valves are used, one of the pick-up leads should be joined to the valve grid and the other to the  $-1\frac{1}{2}$  volt socket of the G.B. battery. A change-over switch may be used for switching from radio to gramophone if desired, but this is by no means essential; a two-socket strip may be attached to the back of the chassis, with a lead from one socket to the grid of the valve and another from the second socket to the G.B. battery. With this method of connection the pick-up leads must be removed from the socket strip when radio reception is desired, and the lead between the strip and the valve grid must be kept as short as possible.

### 'Gram Switch

THE best method of connecting the pick-up is by means of a radiogram change-over switch. The centre terminal of this should be connected to the valve grid, and the two end terminals to one pick-up lead and the junction of the grid leak and grid condenser respectively. When a switch of this type is employed, radio reception will not be obtained when the switch is on the 'gram position, and therefore interference from radio signals will not be experienced. With the simple method of pick-up connection outlined in the last paragraph, radio signal interference may be eliminated in most cases by rotating the main tuning control to a point on the tuning dial where no signals are received.

### Output Valves

WHEN replacing the output valve of a mains-operated receiver it is advisable to use the same type of valve as was originally specified by the manufacturers. Cases have come to our notice where readers have substituted an indirectly-heated output pentode for one of the directly-heated type, with disastrous results. Although the characteristics of directly- and indirectly-heated valves may be alike, they are not interchangeable. In the indirectly-heated type the cathode is connected to the centre pin, whereas this pin is joined to the screening grid in the directly-heated valve. When the indirectly-heated type is fitted the bias resistance is joined between the cathode and the H.T.—line, but in a receiver employing a directly-heated valve this resistance is connected between the centre tap of the filament winding of the valve and H.T.—

If care is taken in the choice of valve it is permissible to substitute a directly-heated valve for one of different make.

conclude the tour with a concert at the Municipal Theatre in Budapest. It is hoped that this tour will do much to increase the prestige of British music abroad, and the programmes have been carefully selected with that end in view. In each capital a different work by a living British composer will be performed as well as a classical symphony or overture, and at least one work by a national of each country to be visited.

Thus, in Paris, the programme will consist of Constant Lambert's "Rio Grande," a Mozart Symphony, the "Sacre du Printemps," and the Fourth Symphony of Roussel. The soloist in "Rio Grande" will be Clifford Curzon. In Zürich the British work will be Walton's Viola Concerto, the Swiss, Honegger's "Chant de Joie," and the classic, Brahms' Fourth Symphony, in addition to the Meistersinger "Prelude," and Busoni's "Two Studies for Doktor Faustus." Lionel Tertis will play the solo part in the Walton Concerto. The Vienna programme will open with Brahms' Tragic Overture, and close with Ravel's "Daphnis et Chloé" (Part 2), the two modern works being the Schönberg "Variations" for Orchestra, and Vaughan-Williams' Symphony in F minor.

At the last concert, in Budapest, Bartók's Four Orchestral Pieces and Bax's Third Symphony will be given, together with the Overture to Euryanthe, Leonora No. 3, and Elgar's "Introduction and Allegro" for String Orchestra.

### New Organ for the B.B.C.

ACCORDING to a recent report, a contract has been placed with the John Compton Organ Company for the installation of a three-manual organ in a B.B.C. Studio at Maida Vale. This instrument will be used to accompany the B.B.C. Chorus and the Symphony Orchestra of 119 players.



Send the children to bed.

### Another Paris Station—Changes Ownership

THE Poste de l'Île de France (222.6 metres), formerly Radio Vitus, is again under the control of the Pathé concern, and will be mainly used in future for the development of television in connection with the film industry.

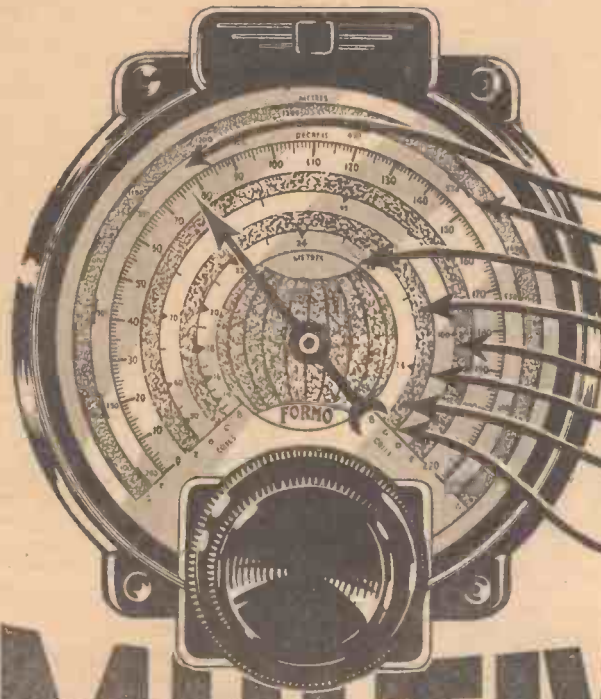
### Accumulator Points

IN order to get the best from an accumulator you should remember to maintain the acid level as stated by the makers by "topping up" with distilled water (don't use tap water) occasionally. Generally speaking, the acid level should be just high enough to cover the plates. Keep the accumulator terminals clean and grease them with a little vaseline to prevent corrosion. The cost of running a charger is extremely small, and apart from the saving you have the satisfaction of keeping your accumulator under your own personal supervision. A trickle charger with reasonable care will give years of efficient service.



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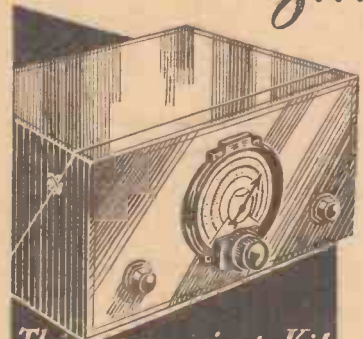
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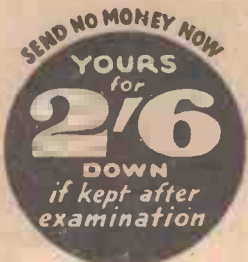
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# Phase Reversal—3

In this Concluding Article Concerning Push-pull Schemes, the Paraphase and Duophase Circuits are Explained and Compared. By W. J. DELANEY

WE have now seen that the term "phase reversal" means nothing more nor less than the application of a similar signal to two separate valves in such a manner that the signal is split into two parts, one half being negative and the other positive, but with the important point that the differences must be exactly "equal and opposite." To sum up briefly, if one half is at any one moment 4 volts positive, the other half must be 4 volts negative, and it must not be a fraction more nor less if distortionless amplification is to be obtained. So far we have dealt with the standard or better-known systems

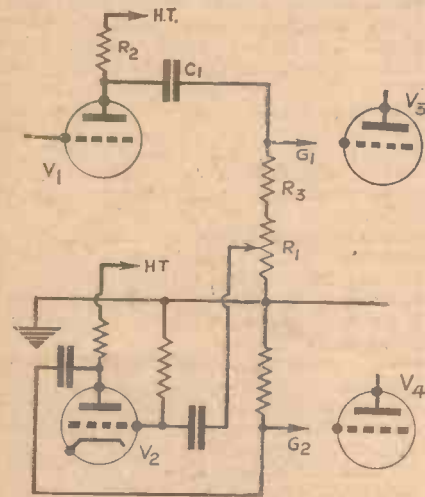


Fig. 1.—The Paraphase circuit as usually shown.

of push-pull amplification, but there are two other systems which are not so well known, principally, no doubt, on account of the names which are applied to them and which are apt to lead a beginner to think that they are complicated or otherwise too involved to be tried. I refer, of course, to "Paraphase" and "Duophase," and if a moment's thought is now given to these terms it will be seen that they both mean more or less the same thing; namely, equal or two phase. Therefore, these two systems are merely modifications of those which were given last week, and such differences as exist are concerned merely in the method of arranging the various components.

## Paraphase

It has been seen that to employ resistance-capacity coupling the load resistance must be split, and several methods of employing a split resistance have been given. In the paraphase circuit, however, an additional resistance of a variable nature is incorporated so that the signal applied to the two halves of the push-pull stage may be not only at equal and opposite potential, but also at equal intensity or volume, and it is only in this latter respect that any difference arises. The circuit is seen in Fig. 1, shorn of unessential details, and it will be seen that one extra valve is

employed, whilst the input signal voltage is fed into a single valve in the ordinary manner. It was explained last week that reversal of phase takes place in each stage of an amplifier, and therefore, if we take the input for one of our push-pull valves from one valve, and the input for the other push-pull valve from an intermediate valve, we shall have signals at opposite potentials. As, however, the intermediate valve must also be fed with the same signal there would be a step-up in voltage and this would result in one of our push-pull valves receiving a stronger signal than the other. As has been explained, however, for ideal results the two halves of the signal must be identical in all respects but phase, and thus we must reduce the volume which is obtained from the intermediate or phase-reversing valve. In Fig. 1, V1 is the input valve of the amplifier, and V2 the phase-reversing valve, whilst V3 and V4 are the push-pull valves. V1 is coupled to V3 by the ordinary resistance-capacity coupling, and for the moment R1 should be ignored, when it will be seen that R2, C1 and R3 are the ordinary resistance-capacity components. Every experimenter is familiar with the method of volume control adopted in a resistance-capacity coupled circuit, where the grid-leak is made variable, and the grid is connected to the variable element, and, for reference, this is reproduced in Fig. 2. By comparing this with Fig. 1, it will be seen that V1 is resistance-

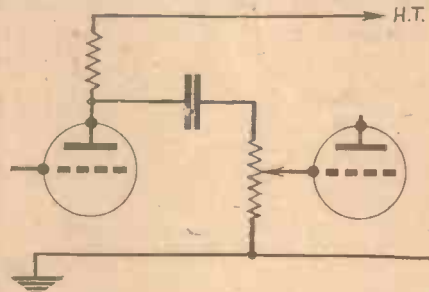


Fig. 2.—A standard R.C. coupled stage with control for volume.

capacity coupled to V2 as well as to V3, and thus R1 becomes the ordinary grid leak for V2. As this forms a further stage of L.F. amplification, the signal present in the anode circuit of V2 must be 180 degrees different in phase, and consequently, this may be applied to V4, again adopting R.C. coupling. It is obvious that by moving the slider of the potentiometer R1 towards the earth line, the strength of the signal applied to V2 may be reduced in intensity, and thus, to use the complete circuit, this is the only adjustment to be made, and in practice this is carried out by means of headphone adjustment to provide the required volume. By re-drawing the arrangement of Fig. 1, but without altering the circuit we obtain the diagram shown in Fig. 3, and this makes the entire scheme more obvious.

## The Duophase System

In the Duophase scheme the standard

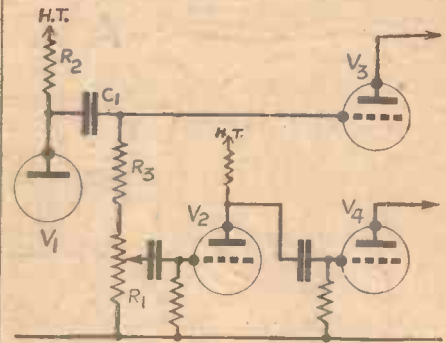


Fig. 3.—The Paraphase circuit re-drawn, from which its function is clearly seen.

transformer coupling forms the basis of the arrangement, with the addition of a special circuit feature which is not, in itself, anything to do with push-pull or phase reversing. The ordinary load into which a valve works is generally of the type known as "inductive," that is to say, it consists of an iron-cored inductance, and, from previous articles in these pages, readers will remember that the value of an inductance varies with the frequency. As, however, the frequency of a signal is varying the whole time the signal is being received, the inductance also is varying, and thus the load on the valve is not constant. Now when considering the output stage, every listener knows that the optimum load of the valve is quoted, and that the maximum undistorted output is only obtained when the optimum load is employed, and thus an inductive load is far from ideal. In the Duophase circuit, the basic arrangement of which is given in Fig. 4, the input valve is provided with a load which, instead of being inductive, is reactive, and the centre-tapped choke may be regarded purely as the centre-tapped transformer secondary winding shown last week. As one end of the choke is connected to the anode, and the other to earth, the signal will appear across the choke, and the application of the H.T. voltage to the centre point will result in the difference in voltage at opposite ends. The connection to earth through the resistance R1 (the load resistance of the valve), coupled with the fact that the two halves of the choke are interwound, brings about the same effect as is obtained in the ordinary push-pull output transformer, namely, the cancelling out of the demagnetising effect of a direct current flowing through the winding, and thus the maximum inductance value is obtained, with the maximum signal voltage differences at points A and B.

In all the push-pull schemes mentioned, the two anodes of the output valves are joined to the ends of a transformer winding, to the centre of which the H.T. feed is taken.

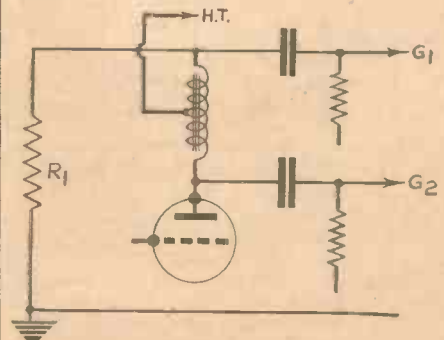


Fig. 4.—The Duophase circuit.



A PAGE OF PRACTICAL HINTS

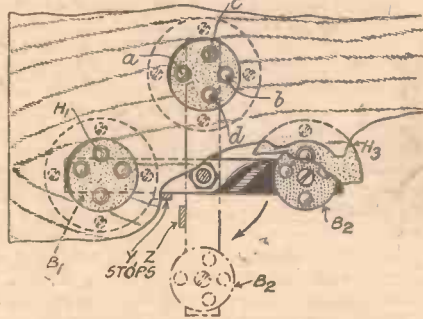
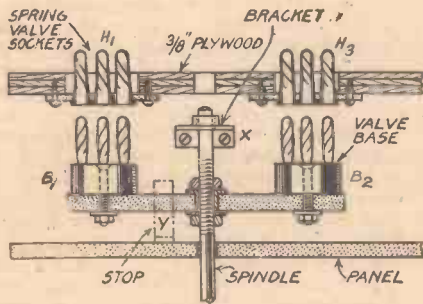
SUBMIT YOUR IDEA

READERS WRINKLES

THE HALF-GUINEA PAGE

A Novel Switch.

TO make this switch cut the tops off two 4-pin valve bases (B1, B2), leaving two plates with four legs each, and mount them by means of a central nut and bolt to an ebonite strip about 3in. long. Pass a threaded rod through the centre of this



A multi-purpose switch made from valve bases and valve-holders.

strip so that about 1 1/2 in. projects on one side to pass through a supporting bracket, as shown in the sketch, and leave a sufficient length for attachment to a knob on the panel. Next, mount three valve-holders with springy sockets on a strip of metal or 3/8 in. plywood, and fix this to the base-board, or chassis, so that when pulled out

	a (Anode)	b (Grid)	c (Filament)	d (Filament)
H1	HT+	GB+	LT+	HT-
H2	HT+	GB+	LT+	HT-
H3	From pick-up or microphone	To grid of valve	Aerial	Earth
B1	To valve anodes	Join to d (HT-)	To valve+filaments	To LT- and earth line
B2	Join these two together		Join these two together.	

of the holders, the valve bases can turn to engage the next set. Two metal brackets, Y and Z, are provided to act as stops to prevent B2 engaging H1 or H2. The sockets are labelled a, b, c, and d, and the connections are as given in the accompanying table, although the constructor will find other uses by having more valve bases and holders. — A. M. WILDING (Wallasey).

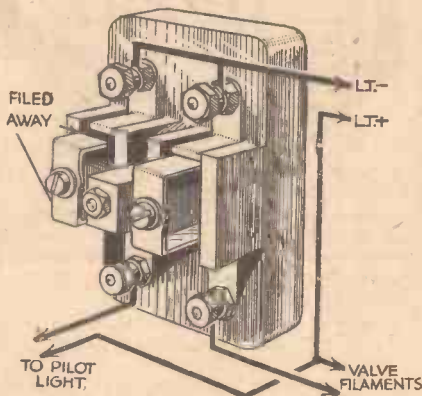
THAT DODGE OF YOURS!

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Dial-Light Economy.

FOR those who wish to economise in the amount of current used for a dial-light, the following wrinkle may be helpful. For the "on-off" switch, a double-pole "knife" push-pull switch, of the type illustrated, is required. The knife-bridge joining the one set of contacts is cut or filed down about three-quarters of its length, so that it makes contact a short while after the other pole passes current, when the switch is pulled on.

To the one terminal of the contacts joined by the shortened bridge a short piece of wire is fitted, this coming from the L.T.—side of the other set of contacts. The corresponding side is connected to the dial-



Adapting an "on-off" switch for controlling a dial-light.

light, whilst a separate lead to the light is also required from the positive side of the accumulator. To the other set of contacts the L.T.—lead is fitted and carried away to the filaments of the valves, as usual.

The set is thus switched on by pulling the switch a small way out, and the dial-light by its being pulled all out. Similarly, when the station has been located the switch can be pushed in a little way, and the dial-light connections broken. The set itself will be still on. — D. R. FISHER (Cinderford).

Output Control Device

THE switch shown in the accompanying sketches is for use with short-wave receivers where, almost in every case, it is often necessary to resort to headphones instead of the speaker. The base of the switch is a paxolin (or ebonite) disc of 1 in. diameter, mounted on a standard fixing bush, to which are bolted the two curved contact strips A and B. Contact B can be of any rigid metal, such as copper, aluminium, or brass, but the other must be of some fairly springy metal, such as thin brass. These strips are fixed at Y and Z respectively by short round-headed bolts, under which soldering tags are clamped, and the free end of contact A is bent upwards, leaving a gap (1/8 in. approximately) between it and B, where the two overlap at X. At this raised end of A, a cut-off head of a similar bolt to those already used is soldered. The rotating arm is shaped from strong brass strip so as to give adequate movement at the tip. This arm is, of course, soldered to the tip of the spindle. The tip is bent in such a manner as to allow it to clip fairly definitely on the heads of the bolts. Connection to the arm is made through a large soldering tag, clamped between the bush and paxolin base. Finally, the heads of the bolts are coated thinly with solder to eliminate any "jerkiness" caused by the slots.

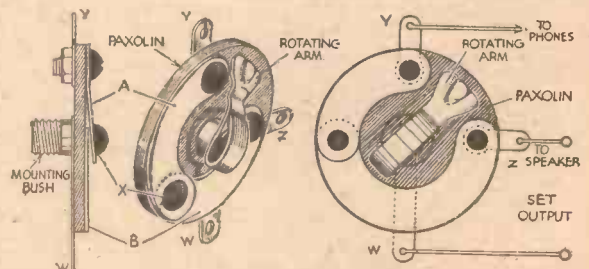
Connection to the set and speaker, etc., is made as indicated by the right-hand diagram.

When the control knob is in a vertical position, the arm is in contact with bolt Y, thus switching into use the 'phones. With the knob turned to the left, the arm and bolt Z are connected, and the speaker only is switched in. When the knob is turned to the right, the arm presses the two strips A and B together at X, making contact between W, Y, and Z, thus switching both 'phones and speaker into circuit.

This switch can also be used, where an extension speaker is employed, to switch either the standard, the extension, or both speakers into circuit. — J. E. DAVEY (Thornton Heath).

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## SERVICING SETS FOR PROFIT.

### II.—Adjustment and Calibration of the Signal Generator

THE previous article of this series dealt with the theory and construction of the H.F. oscillator, and concluded at the point where consideration was being given to calibration. By calibration we mean the determining of particular dial settings to correspond with known wavelengths or frequencies, and a calibration will be needed for each of the three coils we are using.

The easiest method of carrying out this calibration is to press into service a heterodyne wavemeter of known accuracy, but I am afraid that this method is not suitable for the majority of my readers. We shall, therefore, have to fall back on broadcast transmitting stations whose wavelengths we know, in order to do the necessary calibration.

Having ascertained that our signal generator is oscillating satisfactorily we must now select the conditions under which our wavelength calibration is to be made, and I suggest that the instrument is calibrated with the modulation terminals short-circuited and the output potentiometer set about half-way in. With most receivers this will provide a useful signal, and if the potentiometer is always set to the position we select we shall be able to rely on the accuracy of our calibration.

#### Using a Broadcast Signal

Now connect the output leads from the signal generator to the aerial and earth terminals of your broadcast receiver *via* a .0002-mfd condenser as shown in Fig. 1, leaving the normal aerial and earth connections in place. Then tune the broadcast receiver accurately to a station whose wavelength is known, say London National (261.1 metres), then switch on the signal generator and with Coil B in the socket, and the lid of the screening box firmly closed, *slowly* rotate the dial of the tuning condenser from minimum to maximum. Now, if the signal generator is oscillating satisfactorily, we shall hear at one point on the scale a beat note in the loud-speaker of our receiver very similar to that which is produced if we make our set oscillate and then tune in to a station. This beat note always commences as a high-pitched whistle, which falls in pitch to a silent point and then rises again and vanishes as the tuning controls are rotated. The beat note produced by our signal generator will behave in a precisely similar way, and all we have to do is to set the signal generator at the silent point midway between the two

audible notes and jot down the dial reading. Now retune the broadcast receiver to another station and repeat the process until a reasonable number of points have been logged down corresponding to wavelengths between 200 and 450 metres. The E1 coil should then be inserted in the coil socket, and the process repeated with stations whose wavelengths lie between 400 and 550 metres, also tuning the receiver to 900 metres which is usually easily identifiable as the wavelength used by commercial aircraft stations, and taking a reading of the dial setting for this wavelength. Finally insert the G coil and take readings against broadcasting stations whose wavelengths are known between 1,000 and 2,000 metres.

minimum to maximum we shall hear a beat note when it is tuned to 342.1 metres, and if we continue to rotate the dial, a second beat note of slightly smaller strength, when it is tuned to twice this wavelength or 684.2 metres. Thus, by selecting known stations between 300 and 450 metres and putting down the dial settings obtained on the signal generator when its second harmonic beats with these stations we can fill in the gap between 700 and 900 metres, thereby making known the settings for 645 metres which is equivalent to 465 kc/s intermediate frequency.

Turning now to the wavelengths above 2,000 metres, we can take readings in precisely the same way. For instance, tune the broadcast receiver to Droitwich (1,500 metres) and rotate the dial of the signal generator with the G coil in circuit until the beat note produced by its second harmonic is heard. The dial setting will then correspond to 3,000 metres. Similarly Radio-Paris, on 1,648 metres, will give us the setting for 3,296 metres, and so when we have plotted our graph we shall be able to locate 2,727 metres, which is equivalent to 110 kc/s intermediate frequency.

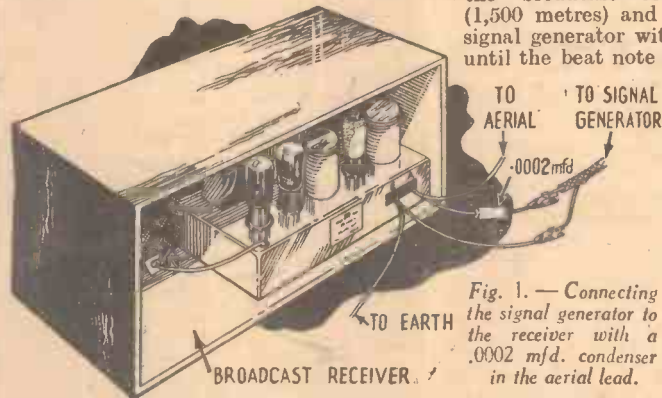


Fig. 1.—Connecting the signal generator to the receiver with a .0002 mfd. condenser in the aerial lead.

#### Calibration Graphs

This will give us a nucleus for drawing calibration graphs on each of the three coils, but it will be noticed that there is a gap in the graphs between 550 metres and 900 metres, and that no readings have been obtained above 2,000 metres. However, these are quite easy to fill in if it is remembered that our signal generator not only produces a fundamental frequency, but also a number of harmonics, the loudest of these being the second harmonic corresponding to a frequency twice that of the frequency to which the generator is tuned. If my readers are not used to thinking in frequencies, the second harmonic will be found at a point equal to half the wavelength of the setting of the generator.

This makes it easy to fill in the gaps in our calibration chart, for if, for instance, we tune our broadcast receiver to London Regional (342.1 metres) and rotate the dial of our signal generator from

#### Beat Note Audibility

So far so good, but there is one point on which we have yet to touch. If our broadcast receiver cannot be made to oscillate, we shall not hear a beat note from our signal generator unless the receiver is tuned to a station, so we must find some means of super-imposing an audible note on the output of our signal generator if we are to

(Continued overleaf)

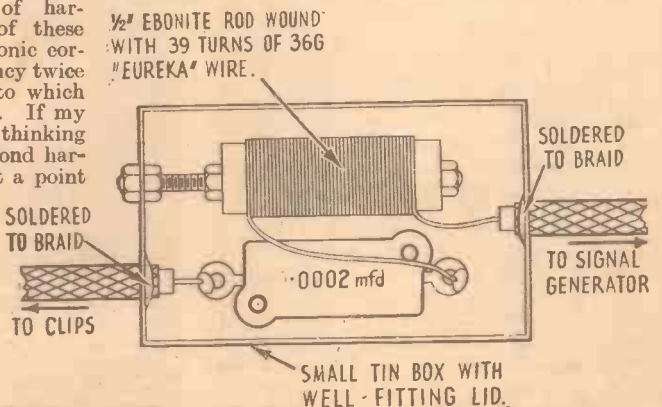


Fig. 2.—The components for a "dummy aerial" mounted in a small tin box.



(Continued from previous page)

use it for adjustment purposes. This is the purpose of the modulation terminals, and we shall find that if we connect the output terminals of the beat frequency oscillator to the modulation terminals of the signal generator and open the modulation switch we shall hear the audible note produced by the L.F. oscillator in the loud-speaker of a broadcast receiver which is connected and tuned in to the signal generator. We shall be able to vary the pitch of the note produced by varying the setting of the dial on the L.F. oscillator and also vary the strength of the note by adjustment of the output potentiometer on this instrument. A word of warning may be necessary here, viz., the output from the L.F. oscillator should never be increased to a point where the beat note produced by the signal generator and a broadcasting station when listened to on a receiver, sounds harsh. If insufficient volume is produced in the loud-speaker of the set, always increase the output from the signal generator, not the L.F. oscillator, otherwise the signal generator may be over-modulated.

#### Using a "Dummy" Aerial

The simple .0002 microfarad coupling

condenser used for calibration purposes will usually be found a satisfactory means of connecting the output from the signal generator to a receiver under test, but some of my readers may wish to construct a more complete "dummy aerial," so I am giving particulars of a suitable one herewith. As will be seen on reference to Fig. 2, it consists of a small brass or tin box, into which the output lead from the signal generator is led at one end, and the shielding braid connected to the box to earth it. Inside the box are mounted a .0002 mfd. fixed condenser, and a small inductance wound with 36 gauge Eureka wire. These are connected in series, and brought out to a further short length of screened lead, the screening of which is again secured to the box. The short length of lead is terminated by crocodile clips in the manner shown. This little accessory serves to reproduce more or less accurately the conditions to be expected when a broadcast receiver is connected to an outside aerial, and if the signal generator is used to calibrate a receiver for wavelength it will be found that the readings obtained will be maintained when the receiver is actually used on a normal aerial and earth system.

Some readers may be interested to know

exactly what the sensitivity of their receivers is in actual terms of microvolts, etc. fed into the aerial circuit. I must make it clear that this equipment will not do this. Measurements of this description require very costly and complicated apparatus, quite beyond the capabilities of most amateurs to construct, but these instruments will provide a means of tracking all the trouble which an amateur or serviceman is confronted with and if used intelligently are capable of giving eminently satisfactory results within the sphere of their capabilities. It should be understood that although each of the instruments which have been described will operate separately, and, indeed, have been designed with that end in view, yet their major usefulness will be achieved if they are used in conjunction with one another.

#### In Conclusion

The final article in this series will be devoted to a description of some of the ways in which the apparatus may be used and will provide excellent reference sheets for all those who have constructed the apparatus, and, I am certain, will show all servicemen how they can halve the time they normally take to make routine tests on receivers.

# The King Makes a Record

How His Majesty's Historic Speech was Recorded for World Distribution

AT the same time as King Edward VIII was making his first broadcast speech to his Empire on Sunday, March 1st, he was also making his first gramophone record since he became King, and it is interesting to note that the "His Master's Voice" Company received exclusive permission to record His Majesty's voice.

The microphone in Broadcasting House was connected by a special high-quality telephone line to the H.M.V. studios at St. John's Wood. Four sets of apparatus were used so that the speech was recorded in duplicate, and soon as one set of discs was completely recorded, another set was started. The speech was thus recorded without a break.

The King's speech came over the telephone line in the form of minute electrical currents, and these were amplified ten million times by a giant amplifier in the H.M.V. Studios. Some of the valves employed in this amplifier stand more than a foot high. The amplified currents were then passed on to the electrical recording instrument, and they vibrated a sapphire point so that it cut a wavy line in a circular disc of soft material. The actual ingredients of the discs are a closely guarded secret, but it is known that soap plays a large part in their composition. For every minute the King spoke, his voice cut a track of over a hundred yards in length on the discs.

As soon as the speech was concluded, the wax discs were placed in a specially heated van, which rushed to the "His Master's Voice" Factories at Hayes, Middlesex. Here a staff were ready to work throughout the night in order to prepare advance samples of the records of the speech, which were to be submitted to His Majesty in order that he may give his approval of their issue.

Copies of the records were on sale in England on March 7th, and all "His Master's

Voice" profits from the sales of the records will be handed to a charity which will be nominated by His Majesty.

#### Special Transport Arrangements

The H.M.V. Company have made arrangements to send the metal dies, from which records may be pressed, to their associated companies in all quarters of the globe. Trains, cars, aeroplanes, ships, camels, mules, ox wagons and the heads of native boys will be among the methods of transport used to take the King's record to his

subjects who are residing in the most distant parts of the globe, and who desire a permanent memento of this historic speech.

The King's own copies of the finished records will be mounted in a special album of royal blue, stamped with gold.

Arrangements have been made for "His Master's Voice" to deposit in the British Museum a hermetically-sealed case containing metal dies, from which it will be possible, thousands of years hence, to press perfect records of the speech the King made to-day.



"His Master's Voice" engineers recording the King's speech. The records were issued on March 7th, and distributed to all parts of the world. "H.M.V." are giving their profits from the sale of these records to a charity to be nominated by His Majesty.



# Replacing the Valves

It is in some respects unfortunate that present-day valves continue to function for such a great length of time before burning out. The reason is that in many instances listeners "make-do" with reception which is not nearly as good as it should be, due to the valves being well past their prime. A difficulty arises because it is not always an easy matter to tell whether or not the valves are "up to standard." This can be done quite easily, of course, by means of a tester of the type which enables the mutual conductance to be checked, or even by taking anode-current readings at various bias voltages and comparing these with the figures given by the makers for new valves.

## Lost Efficiency

The main point to bear in mind, however, is that valves do frequently become less

An Outline of the Factors to be Considered when Buying New Valves, Especially when They are to Replace Others of Obsolete or Obsolescent Types  
By FRANK PRESTON

## Using "Better" Valves

After it has been decided that it would be worth while to replace a valve, the question of the type of valve to be used in its place arises. It might be considered an obvious procedure to use a new valve exactly like that which has become faulty, but in many

Osram L.P.2, and Mullard P.M.2A, to mention a few. These valves give a greater degree of amplification than ordinary small triodes, and are intended for use when only a single L.F. stage is used and when it is not desired to employ a pentode: their consumption of L.T. and H.T. current is no more than that of ordinary triodes.

## Pentodes for Triodes

In using valves of this type for replacement purposes, no alterations need normally be made, unless to the G.B. voltage. The valves are provided with four-pin bases of standard type. Rather more care must be exercised when replacing a triode by a pentode, however, for the connections must slightly be modified, and if a valve of incorrect type is chosen, the high-tension current may be a good deal greater than the supply unit can satisfactorily supply. The following are a few of the pentodes which can normally be used to replace small power valves without any difficulty arising: Cossor 220 H.P.T., Graham Farish P.T.2, Hivac T.220, Osram P.T.2 and P.T.2-K., Mazda Pen. 220, and Mullard P.M.22A. Each of these valves has a maximum undistorted output in the neighbourhood of 500 milliwatts, and the combined anode and screening-grid current does not exceed about 10 mA at 120 volts H.T. In other words, although they provide a greater output than a small triode, they are equally economical of current.

In using a valve of this type it is necessary to replace the existing 4-pin valve-holder by one of the 5-pin type; the connections are as before, with the exception that an additional lead must be taken from the screening grid socket (centre) to a tapping on the H.T. battery (see Fig. 2). There is another point to remember, which is that the optimum load of the pentode will be much higher than that of the triode which it replaces. This means that for the best results different tapings on the speaker transformer must be used. If the speaker is not of the "universal" type it might be worth while to have the transformer changed by the makers, but if this expense is objected to it will be better to use a high-amplification triode, as mentioned above.

## Tone Correction

As most readers are aware, a pentode has a tendency to give emphasis to the higher  
(Continued overleaf)

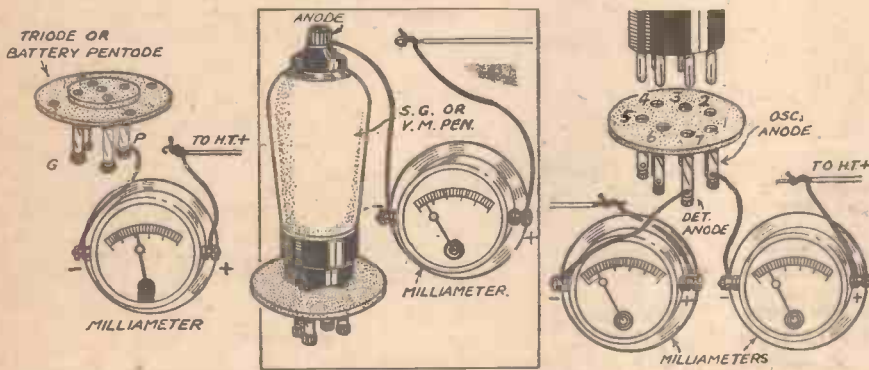


Fig. 1.—Methods of checking anode current for different types of valve.

efficient after they have been in use for some time; often there is no sign of a falling-off in performance for a few years, but in other instances the emission begins to get less after a year or so. In view of these facts it is a good plan every six months either to test each valve in the set or to have them tested by a reputable dealer. A better method, and one to which most good dealers will agree, is to try the effect of replacing the valves by new ones or by others which are known to be in perfectly good condition. It is a good idea to ask the dealer to send his service engineer round with a new set of valves of the same or corresponding types as those already in the set and allow you to make a definite comparison.

## Anode-current Tests

If, for any reason, this procedure is inconvenient, the next best thing when a valve tester is not available is to measure the anode current of each valve in turn at intervals of a few months and compare the readings. A drop in current will immediately indicate that the particular valve is becoming less efficient, provided, of course, that the H.T. voltage is the same as when the previous test was made. The method of testing is perfectly simple and is as shown in Fig. 1; a milliammeter is connected between the anode terminal of the valve and the lead to high-tension positive. The position of the anode connection varies according to the type of valve and holder employed, but connections for the simpler types are shown in Fig. 1.

cases this would not be the ideal method, and in a few instances it would even be impossible. Valves have been improved very considerably during the past few years, and it would be foolish to buy an obsolete type of valve simply because it happened to be like the old one. As an example of this, suppose it were intended to replace a small power valve in an S.G., det., P. receiver. The power valve originally

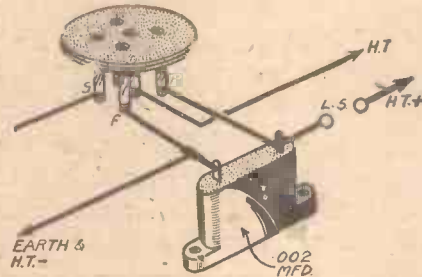


Fig. 2.—When replacing a small power valve by a pentode, a 5-pin holder must be used, a lead being taken from the centre socket to H.T.+ as shown, and a fixed condenser joined between the anode socket and earth.

used would probably be of a type which provides a low amplification, and, consequently, only a modest volume for a given input. That being the case, it would definitely be worth while replacing it by either a pentode of the high-efficiency, low anode-current type, or by a high-amplification triode, such as the Cossor 220 P.A.,

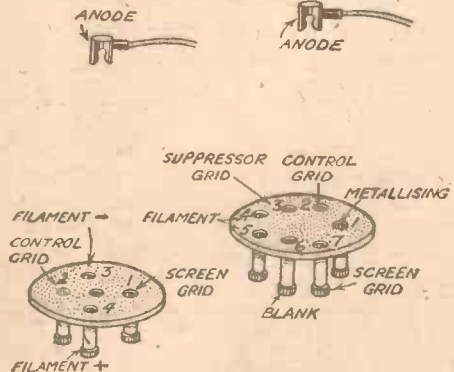


Fig. 3.—These two valve-holder illustrations clearly show the altered connections required when replacing a 4-pin H.F. valve by a 7-pin H.F. pentode.

(Continued from previous page)

musical frequencies, and it is generally recommended that a tone-correction device be used. But despite this, many listeners prefer the tone provided by the pentode, so that in practice the extra fitting is not always required. Details of the condenser and resistance required are given on the makers' instruction sheet, but it will very often be found quite sufficient to connect a fixed condenser between the anode of the valve and earth, as shown in Fig. 2. The value of the condenser can be varied to suit individual requirements, but .002 mfd. frequently provides adequate correction.

**The H.F. Stage**

When replacing a high-frequency valve of the S.G. or variable-mu type it is worth while to use a variable-mu pentode in its place. This type of valve can be used either with or without the variable-mu control, and the latter can be added later on if desired. Modern variable-mu H.F. pentodes can be obtained with 4-pin or 7-pin bases, but it might sometimes be found easier to obtain a 7-pin valve when a replacement becomes necessary. This will involve the replacement of the existing valve-holder, and the connections must be changed as indicated in Fig. 3. Where chassis-mounting valve-holders are used it will be necessary slightly to enlarge the hole in the chassis, and this can be done with a rasp or coarse file. Representative variable-mu H.F. pentodes are: Cossor 210 V.P.T., Hivac V.P.215, Osram V.P.21, Mazda V.P.215, and Mullard V.P.2.

**Loss of Stability**

It is possible that the change may at first cause the set to become unstable—

this is because of the higher efficiency of the new valve—but a few slight modifications should clear this difficulty and make the set more sensitive than it ever was before. When the set originally had a variable-mu control, stability should be secured by working with a lower setting of the potentiometer and by varying the screening-grid potential. Where such a control was not provided, it might be added, or a fixed bias may be applied as shown in Fig. 4, by inserting a .0002-mfd. fixed condenser in the lead between the tuning coil and the grid, and taking a lead from the grid through a 1-megohm grid leak to the 1½- or 3-volt tapping on the G.B. battery. Even when using this fixed bias the new valve will nearly always give better results in the way of increased range and greater selectivity than the old one.

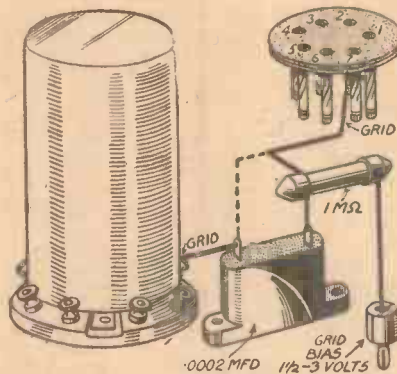


Fig. 4.—Fixed bias can be applied to an H.F. pentode by using the simple connections shown here.

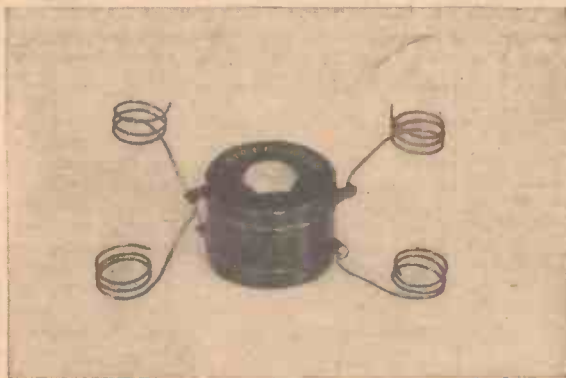
**The New Detector**

With regard to the detector valve, it will rarely be desirable to change to a type different from that previously employed, unless it is considered worth while to modify the circuit to take an H.F. pentode. The modification is comparatively simple, and has been dealt with at length in these pages before.

When it is not proposed to make any circuit modifications the best type of valve is nearly always one of the super-detector class, which is represented by the Cossor 210 Det., Hivac D.210, and Mullard P.M.2 D.X. These valves have a comparatively low amplification factor, but they are very stable and provide a very smooth reaction control. They are very suitable for use with transformer or parallel-fed transformer coupling, especially when the coupling component has a step-up ratio of 1.5 or more. When greater amplification is required of the valve—for example, when a low-ratio transformer or resistance-capacity coupling is used—somewhat better results can be obtained by using a replacement valve of the H. or H.L. class; these have an amplification factor of about 25, compared with one of about 15 for the super detectors.

**Care with Mains Sets**

The same general rules as those outlined above apply also to mains sets, but greater care must be taken with those because the power-supply unit is invariably designed to give an output which is just right for the valves originally used. Additionally, valves of different type will gradually call for different bias resistances and so on.



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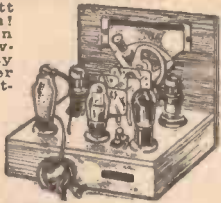
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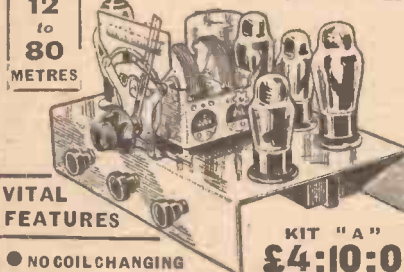
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# SHORT WAVE SECTION

## BETTER RESULTS FROM THE SHORT-WAVER

Helpful Notes on the Operation of a Short-wave Set or Adapter, with Suggestions for the Improvement of the Simpler Type of Instrument.

**N**UMEROUS articles have been published in these pages giving constructive details for most types of short-wave receiver, adapter and converter, and there is ample evidence that a large number of readers have built successful instruments from these designs. It is also evident, however, that there are many readers who do not obtain the very best results of which the receivers are capable. There are many reasons for this, but the most important is that the constructors have not acquired the special short-wave technique, if such a word may be used. They have not learned to appreciate the "feel" of a short-wave instrument, and use it in just the same manner as they do a standard broadcast set.

### "Dial Sense"

It would be impossible to teach anyone to handle a short-wave receiver to the best advantage, for the process of learning is not unlike that of learning road sense when driving a vehicle on the road. All that can be done, therefore, is to make suggestions and to deal with a few of the finer points which make a great deal of difference; the rest remains with the listener, who must acquire by experience the particular sense of touch which is necessary. The above remarks should not be construed to mean that it is difficult to operate a short-waver satisfactorily, but that to obtain the very best results calls for a study of a few important items.

Many readers have no doubt read in our "Letters from Readers" pages of the remarkably good reception obtained by their fellow enthusiasts, often with the simplest possible types of outfit, and wondered why they could not do likewise. The difference is generally one of skill, for, unlike a fool-proof broadcast set, the short-waver is extremely sensitive to careful and experienced hands. That this is the case is evident from the fact that many readers who built the simple single-valve receiver described in this journal in the issue dated September 14th, 1935, have reported clear reception of stations as far away as Australia, as well as of comparatively low-power American amateur transmissions, whilst others who have made precisely the same instrument have found their range to be limited to a few European S.W. broadcasting stations.

### The Standard of Reception

It must, of course, be admitted in the first place that the situation and arrangement of the aerial-earth system has a pronounced effect on the results to be obtained, but this factor is nearly always of lesser importance than what might be

termed the human element. Given a well-designed S.W. set—such as any of those described in this journal—and an aerial system of moderate efficiency, it should, under reasonably favourable conditions, be possible to receive American short-wave stations on two valves, and generally on one when using a sensitive pair of 'phones. If this standard of reception has not been reached it is worth while to search for a reason.

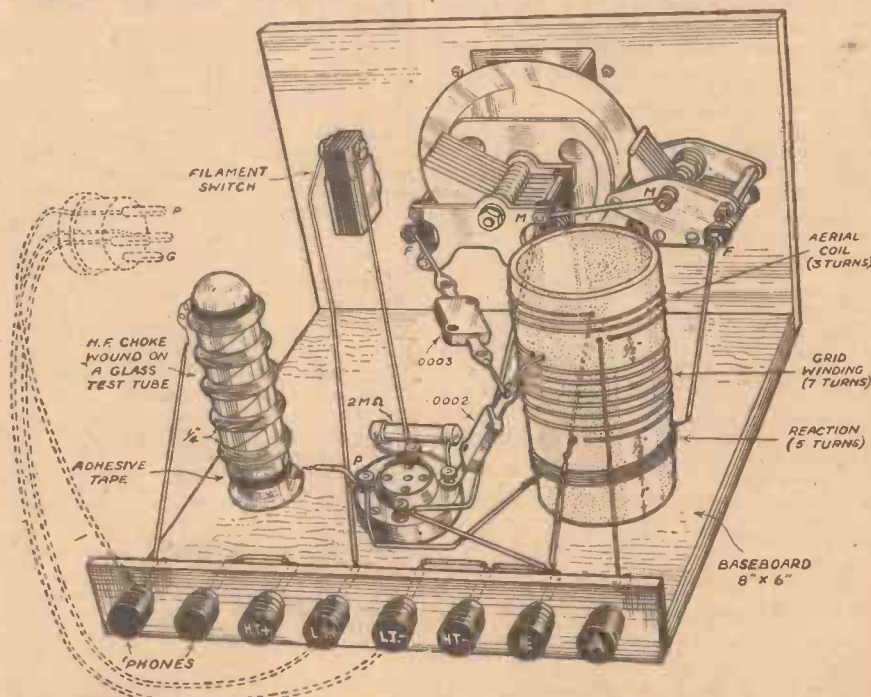
### Turning the Knobs

The most important point of all is that one should learn to operate the tuning and reaction controls slowly, smoothly, and at the same time. This might appear rather difficult at first, but a little practice will soon simplify matters. After the batteries, aerial, earth and 'phones (it is best to use 'phones with a simple type of set until its operation has been completely mastered) have been connected, turn the tuning pointer to zero and advance the reaction control until a faint "hissing" sound is heard. If a sudden "plop" is noticed as reaction is slowly advanced it is generally a sign that too much H.T. is being applied, or that the earth connection is not as good as it should be. After the set has been brought just to the point of oscillation, as the "hissing" sound indicates, the tuning dial should be slowly rotated whilst care-

fully listening for signals. It might be found that the "hissing" ceases after the pointer has moved over a few degrees, and this shows that the detector valve has stopped oscillating, and that a little more reaction should be applied. It will soon be found that it is quite an easy matter to operate the tuning and reaction controls together so that the set is kept just on the verge of oscillation over the complete range of the tuning condenser. When the carrier-wave (whistle) of a station is heard, the reaction control should be turned back slightly and slowly until signals are heard, clearly. The exact tuning point should then be accurately checked by slightly modifying the setting of the tuning condenser. Care must be taken that too much reaction is not applied, because the sensitivity of the set is reduced almost as much by using too much as too little reaction, and thus the control must be used with discretion.

### Lack of Oscillation

Should it be found that, at one point on the tuning scale, the set will not oscillate whatever the position of the reaction condenser, either insufficient H.T. voltage or too close an aerial coupling is being used. The remedy in the first case is obvious where a battery set is concerned, and in the latter case the proper course is to reduce the capacity of the aerial series condenser,



Pictorial diagram of the simple single-valve short-wave receiver referred to in the text.



where used, or to move the aerial coil away from the grid coil when there is a variably-coupled aerial circuit. If a variable aerial series condenser is not fitted, it is in nearly every case worth while to fit one by connecting one terminal to the aerial lead and the other to the aerial terminal on the set. By reducing the capacity of the series condenser the "damping" effect of the aerial is reduced, so that the detector valve will oscillate more readily. It is thus often possible to obtain considerably better reception of certain stations after varying the capacity of the series condenser.

Another advantage of the variable series condenser is that it can often be used as an effective volume control. The only objection is that an alteration of its capacity is inclined to alter the tuning of the set. For example, if a station is received at 30 degrees when the capacity of the series condenser is at maximum it might be necessary to "follow" the station round

to 35 degrees as the capacity of the aerial condenser is reduced. This difficulty can best be overcome by having two condensers in series with each other between the aerial lead and the tuning coil. The first condenser should be a .0001-mfd. variable, and the other a .0001-mfd. fixed. The effect of the fixed condenser is to minimise the effect on tuning of varying the capacity of the variable unit.

### A Reaction Refinement

When it is found that the capacity of the reaction condenser cannot be increased uniformly as that of the tuning condenser is increased, and the above suggestion has been tried, it is well to try the effect of including a fixed non-inductive resistance in the reaction circuit. The resistance, which may have a value of about 500 ohms, may be connected either between the reaction condenser and the reaction coil, or between the coil and the anode of the

valve, assuming that the moving plates of the condenser are joined to earth and the fixed vanes to the coil as they should be.

### Variable High Tension

Mention was made above of varying the high-tension voltage, and it is a fact that this is often rather critical, even with modern valves. So that exactly the most suitable voltage can be applied and found by trial, it is frequently a good idea to use a variable resistance for decoupling purposes. A component with a total resistance of 50,000 ohms is suitable, and the centre and one of the end terminals should simply replace the terminals or wire connectors of the normal fixed resistance. This idea is particularly valuable in a mains receiver, where H.T.-voltage variations cannot be made so easily, but it is also worth using in a battery set, since it makes possible an easy change in voltage whilst the set is in use, and even when a station is being received.

## Leaves from a Short-wave Log

WE may expect to pick up further transmissions from Oslo via LKJ1, Jeløy, on both channels allotted to this station, as it is the intention of the authorities to extend the activities of the short-wave transmitters. Broadcasts are to be made in the near future between G.M.T. 01.00-03.00, and to cover costs, there is a possibility that advertisements may be included in the programmes. So far, the wavelengths used have been 31.48 metres (9,530 kc/s) and 48.94 metres (6,128 kc/s), but steps are being taken to secure an additional channel.

Our old friend, PCJ, Eindhoven (Holland), is back on the air on 31.28 metres (9,590 kc/s), although so far, no regular schedule of programmes has been advertised. It was logged recently transmitting a KRO programme from Hilversum 2 (301.5 metres), destined to the Netherlands East Indies and Eastern Asia. All announcements were made in Dutch, German, English, and French.

It is unfortunate there should be so many stations using this frequency; it is the channel used by VK2ME, Sydney (N.S.W.), HP5J, Panama City, PKYDB, Soerabaya (N.E.I.), W3XAU, Byberry (Pa.), the short-wave outlet of WCAU, Philadelphia, and is only separated from HBL, Prangins (Radio Nations) by 5 kilocycles, and from GSC, Daventry, by 10 kilocycles.

### Swiss Transmissions

Other loggings recently made were HBO and HBP, Prangins (Switzerland), on respectively 24.94 metres (12,030 kc/s) and 38.48 metres (7,797 kc/s) with a relay of a Zürich or Berne programme to the U.S.A., and also DJC, Zeesen, broadcast with, as alternative channel, DJJ, on 29.87 metres (10,042 kc/s), taken by WEA and WQP, Rocky Point (New York) on respectively 28.28 metres (10,610 kc/s) and 21.58 metres (13,900 kc/s), also for American consumption.

The new Bulgarian short-waver, LZA, Sofia, has also again been well received on 20.04 metres (14,970 kc/s), giving announcements in several languages, including French and German. An experimental transmission of gramophone records was picked up on two different dates between G.M.T. 12.15-14.00.

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# IMPRESSIONS ON THE WAX

By  
T. Onearm

### A Comedy Tune

A TUNE which seems to be very popular at the moment is "The Music goes 'Round and Around.'" This is amusingly played by Lew Stone and his Band on *Decca F5846*, coupled with "Marilou," which although different in style is equally attractive.

### From Grand Opera to "Talkies"

THE immense popularity of the talkie film is attracting artists who previously have only been heard in Grand Opera. Beniamino Gigli is the latest recruit to the films, and this month are recorded four songs introduced in his first film, "Lullaby." They are "Say You Will Not Forget" (Non ti Scordar di me) and "The Lullaby" (Mille Cherubini in Coro) on *H.M.V. DA1458*, and "Venetian Serenade" (Serenata Veneziana) and "Come Back to Me" (Addio bel Sogno) on *H.M.V. DA1459*. In this instance the songs are already known to most concert-goers, but they will be a revelation to the average film fan, especially the "Lullaby" which is an arrangement of Schubert's "Wiegelielied."

Elisabeth Schumann adds to her repertoire of records in English. She sings Ronald's "Down in the Forest" and "Last Night" on *H.M.V. DA1457*. In the latter, which is about a nightingale, she gives an astonishing imitation of the bird's characteristic trill.

### New John McCormack Record

THE above artist has made a fine record this month on which he sings two of Foster's songs, "Sweetly She Sleeps, My Alice Fair" and "Jeanie with the Light Brown Hair" on *H.M.V. DA1405*. Foster may be better remembered by his plantation melodies "Swanee River" and "Old Black Joe."

By contrast is a record by Lawrence Tibbet. On one side he sings "De Glory Road" (which he will sing in the film "Metropolitan") in which he describes the adventures of a negro on his way to Heaven. The other song is Loewe's sombre "Edward." Both songs are fine examples of dramatic singing. The number of the record is *H.M.V. DB1684*.

### On the Lighter Side

JOAN CROSS, the star of the Vic-Wells Opera Co., has recorded this month "They Call Me Mimi" ("La Bohème") and "One Fine Day" ("Madame Butterfly") on *H.M.V. C2824*.

Noel Coward adds to his records from "Tonight at 8.30" with "We Were Dancing," coupled with one of his earlier successes "Parisian Pierrot" on *H.M.V. B8414*.

Those experts in cross questions and crooked answers, Naughton and Gold, make

their bow on *His Master's Voice* this month. They have two arguments concerning "Income Tax" and "Holidays" on *H.M.V. BD328*.

A revival of one of the most popular rhythmical records of recent years is recorded by Paul Whiteman and his Orchestra on *H.M.V. C2823*, coupled with the Salon Orchestra playing "Manhattan Serenade."

### Dancing Time

JACK HYLTON and his Band have made two popular numbers (recorded in America) in "The Music Goes 'Round and Around'" and "Lights Out" on *H.M.V. BD5035*. Roy Fox's latest records include "Play, Orchestra, Play," from Noel Coward's Show "Tonight at 8.30" and "If I Should Lose You" on *H.M.V. BD5025*, and "The Star and the Rose" and "Quicker Than You Could Say 'Jack Robinson'" on *H.M.V. DB5026*.

The new band, the Ballyhooligans, make a medley fox-trot which they call "The Ballyhooligans Make Whoopee." This introduces six famous dance tunes, three on each side of *H.M.V. BD5032*. Ray Noble's Orchestra with vocal refrain by Al Bowlly plays "With All My Heart" and the reverse side of the same record *H.M.V. BD5028* contains "The Broken Record" by Guy Lombardo and his Orchestra. In a recent radio voting competition in America, Lombardo's Orchestra was placed first. "Tats" Waller exhibits his rhythm and his "hot" piano playing in "Woe is Me" and "I'm Going to Sit Right Down and Write Myself a Letter" on *H.M.V. BD5031*. If you are a rumba fan you will like the Rumba Medley by the Continentals on *H.M.V. BD5033*. This introduces such favourites as "Mama Inez" and "The Peanut Vendor."

Joe Loss and his Orchestra add to their records in strict dance tempo with "Log Cabin Lullaby" and "Looking Forward to Looking After You" on *H.M.V. BD5036*.

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**PIEZO APPLICATIONS**

(Continued from page 10)

lightness and the flexibility of the crystal element, need very little mechanical damping, and so have a wide frequency response. Taking the output at 1,000 cycles as the standard of reference, the response rises slightly at lower frequencies down to 25 cycles, but is substantially uniform up to 4,500 cycles and is only about 11 decibels down at 8,000. Some greater attenuation at the two extremes of the range is obtained by reducing the total resistance of the volume control from the recommended figure of 500,000 ohms to 100,000 ohms.

**Loud-speakers**

Piezo-electric speakers fall into two different types; the first, which is intended mainly for reproducing the higher notes and is therefore used in conjunction with an ordinary moving-coil speaker, which is responsible in the main for the bass and middle register; and the second type which may be employed by itself or in conjunction with a moving-coil speaker. Dealing first with the type intended merely

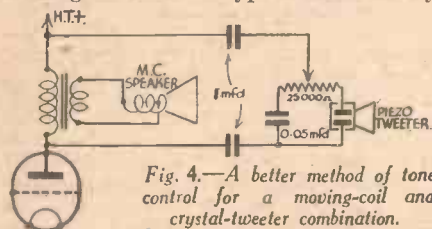


Fig. 4.—A better method of tone control for a moving-coil and crystal-tweeter combination.

for top-note reproduction, it must be remembered that sometimes a moving-coil speaker has a cut-off at about 4,500 cycles, and in some cases a fairly pronounced resonance near 3,000 cycles.

It is possible, however, to restrict the moving-coil speaker to the part of the audio-frequency range below about 2,000 or 3,000 cycles, and to make use of the good high-note response of the piezo type of speaker for the higher frequencies. Such a speaker is termed a "tweeter," and under normal conditions has a reasonably uniform response between 1,500 and 12,000 cycles. Fig. 3 shows the simplest way of connecting up a tweeter to the crystal type, a small variable condenser being used as a tone control, its function being to vary the input to the tweeter. A still better arrangement is that shown in Fig. 4, which has the advantage that it produces a falling characteristic in the moving-coil speaker and thus avoids the high note peak already referred to, and therefore gives a uniform response over the whole frequency range of the complete combination.

**No Magnets**

The larger types of crystal speaker are quite suitable to use solus, and some are available which will handle inputs up to 6 watts. They may also be used in combination with moving-coil speakers in a similar way to tweeters, and various combinations in the form of dual speakers can be secured.

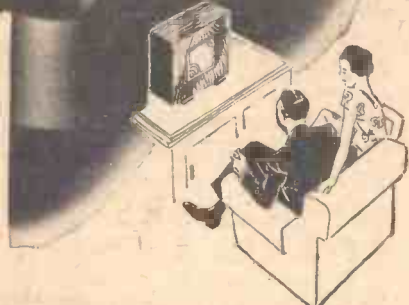
One point to be noted is that, unlike the moving-coil speaker, piezo speakers have no field magnets, either permanent or energised. They are more sensitive than moving-coil speakers, and are thus of considerable advantage for use with battery sets where limited output is available. Crystal speakers used solus need an L.F. choke connected in parallel with them—suitable types are supplied by the makers of the speakers—the object of the choke being to divert the L.F. output through the speaker while affording a passage for the D.C. component.

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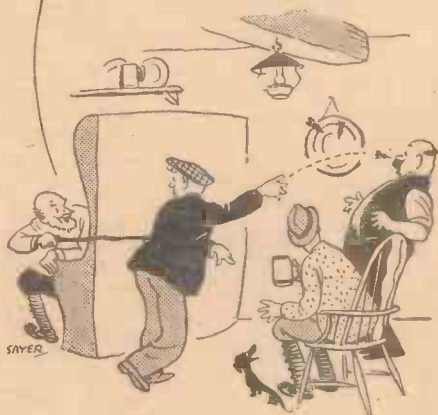
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## The Peto-Scott Sensitive S.G.3 Kit

An Interesting Easy-to-build and Efficient  
Three-valver which is available in Kit Form.

If a census of receivers were taken it would undoubtedly show that the majority of listeners rely upon the H.F., detector, and output type of circuit, and this has been proved to provide maximum performance under practically all conditions. It gives a good selection of stations under normal atmospheric conditions, and it is not essential to spend hours in erecting a highly efficient aerial, although, of course, results are still better when a good aerial is employed. The output valve will deliver ample volume if it is of the pentode type, and may be fully loaded on a number of stations, and thus it may safely be said that for general all-round results the S.G. detector, pentode receiver is hard to beat. In the new kit by Peto-Scott this is the circuit which is adopted, and the two tuning coils (aerial and anode) are of the efficient unscreened type, mounted as far apart as the receiver will allow. This results in a lowering of cost, and at the same time gives the effect of a screened coil assembly in view of the fact that the ganged condenser is interposed.

### Component Details

The condenser is provided with a concentric trimming control, and in addition to this there are a reaction condenser and two switches mounted on the front of the panel. One switch is for switching on and off, whilst the other is a five-point switch for wave-changing on both coils. A standard metaplex chassis is employed, and is included in the kit ready drilled, and with all holes made for inter-connecting wires. The rear chassis runner is also drilled for the accommodation of the socket strips, and thus the only tools required to build up the receiver are a screwdriver and a pair of pliers. Even these may be dispensed with in an extreme case and a simple penknife employed. A full-size blueprint is supplied and there are only two components to be mounted on the chassis in addition to the coils and valve-holders. The remainder of the fixed condensers, resistances, etc., are included in the actual wiring and are held in place either by their own wire ends or by the leads.

In addition to the various components which are supplied in the manufacturers' boxes, there is an additional box in which will be found all the smaller essentials, such as the five-way battery lead, length of single rubber-covered flexible, connecting wire and insulated sleeving, packet of screws, and the fuse bulb and dial light, with an additional bulb as a spare.

### Test Results

A kit was assembled without any difficulty and was tried out under our usual conditions. Ganging was extremely simple to accomplish (the trimmers being mounted on top of the condenser and are fully visible), and by rotating the main tuning dial thirty or forty stations were heard on the loud-speaker. Conditions were admittedly good on this occasion, but by adjusting the reaction control just short of oscillation point, and by a judicious use of the concentric trimmer, dozens of stations could be tuned in without interference. With reaction at zero, there was a silent band between the two London stations, but again the Midland could be obtained.

The price of this kit is £1 15s. 0d.





FROM STUDIO TO LISTENER—9

A Description of the Output Stage with Special Reference to Speaker Matching and Undistorted Output. By IDRIS EVANS.

THE terminating paragraph in last week's article was incorrectly worded, owing to a printer's error, and should read as follows: When the varying signal voltage is applied to the grid of this valve, the current in the anode circuit rises and falls, and this rise and fall of the current through the impedance of the speaker winding provides the power which is converted into sound.

Methods of Connecting Speaker

In battery operated sets using a low-consumption power valve in the output

of large dimensions, distortion due to core saturation can also be avoided—this type of distortion is often prevalent when a speaker having a small-cored transformer is connected directly in the anode circuit. Beginners sometimes ask whether a resistance can be used in place of the above-mentioned choke; a resistance is quite suitable in the anode circuit of the low-frequency amplifying valve, but as a high value resistance would be necessary in the output valve anode circuit in order to provide the required choking effect, this would cause an excessive drop in the voltage reaching the valve anode, with a resultant drop in efficiency.

FOR THE NEW READER

Previous articles in this series have dealt with Principles of Transmission; Methods of Modulation; H.F. Amplification; Rectification and L.F. Amplification.

Transformer Coupling

The majority of commercial receivers employ transformer coupling in the output stage, the transformer being usually attached to the speaker, with its primary winding connected directly in the anode circuit, as shown in Fig. 1. This type of coupling is slightly cheaper than the choke-capacity type, but can be relied upon to provide efficient results provided that the transformer is carefully chosen to suit the valve and speaker in use.

In order to obtain optimum results from the output valve it is necessary to match it to the speaker, this being done by using a transformer having the correct primary to secondary ratio between the valve and speaker. Best results are obtained when the impedance of the speaker is equal to what is known as the optimum load of the valve; a detailed description of this term is beyond the scope of this article, but it is pointed out that the optimum load is stated on the leaflet enclosed with the valve. The load resistance is high (usually between 1,000 and 10,000 ohms), and therefore

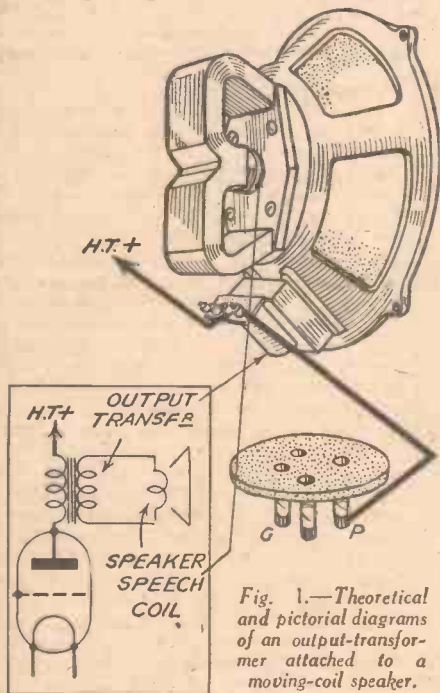


Fig. 1.—Theoretical and pictorial diagrams of an output-transformer attached to a moving-coil speaker.

stage, a moving-iron (cone) type of speaker is often connected directly in the anode circuit, as shown in Fig. 2, page 820. If a high consumption super-power valve is used, however, a choke-capacity filter circuit is employed, as shown in Fig. 3, page 820.

With this method the direct current passing from the H.T. unit or H.T. battery to the valve anode does not pass through the speaker winding. The alternating signal current at the anode of the valve, on the other hand, cannot pass through the choke owing to the impeding effect of the latter, and therefore reaches the speaker via the coupling condenser.

This method of connection allows a maximum percentage of the available H.T. voltage to reach the anode of the valve, as a low-resistance choke may be used. By using a choke having a core

it is permissible to connect the cone type of speaker directly in the anode circuit, as the resistance of the winding of this type of instrument is high; if transformer coupling is used a ratio of 1 to 1 is generally found to be suitable. The moving-coil speaker has a speech winding of very low resistance, however, and therefore a transformer having a high primary to secondary step-down ratio is necessary; it is emphasised that this step-down ratio transformer must be used in conjunction with a moving-coil speaker even if choke-capacity coupling is employed. For the benefit of readers who are interested in formulae it is pointed out that the required transformer ratio can be decided by calculating the square root of the

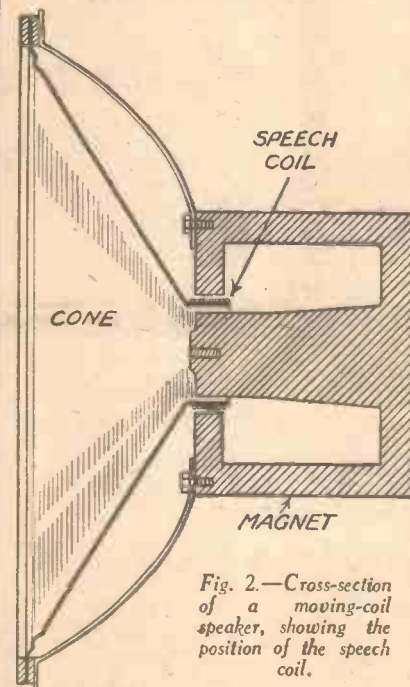


Fig. 2.—Cross-section of a moving-coil speaker, showing the position of the speech coil.

valve optimum load divided by the impedance of the speaker speech coil.

Undistorted Output

The undistorted power output available from the last valve is often confused with the wattage dissipation of the latter, and the beginner can certainly be excused for confusing these two characteristics as most valve manufacturers state the wattage dissipation and not the wattage output. The dissipation is found by multiplying the voltage at the valve anode by the direct current (in amps.) passing through the anode circuit, whereas the power output is that which operates the speaker and is governed by the alternating signal currents in the output circuit. The undistorted output of a valve is the power output which can be handled with a negligible degree of distortion. The undistorted output is generally about one-fifth of the wattage dissipation; for example, a valve which passes an anode current of 50 milliamps when the anode voltage is 250 volts has a dissipation of 12½ watts, and an undistorted output of approximately 2½ watts. When the wattage rating of a receiver is quoted, readers should therefore ascertain whether power or anode dissipation is being referred to, bearing in mind that the wattage that matters to the listener is the undistorted output wattage.

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All letters must be accompanied by the name and address of the sender (not necessarily for publication.)

### An Amplifier for the Deaf

SIR,—I was greatly interested in the letter of "Social Exile" regarding an amplifier for the deaf, and venture to offer the following suggestions for such an amplifier, for, having been deaf for over fifteen years, I have tried almost every deaf aid on the market of the non-valve type. I have also made up a two-valve amplifier, but with indifferent results, and have also constructed, from the designs published several years ago, a two-valve amplifier, using a moving-iron speaker as the "mike." It was of no practical use, however, for, in addition to being very insensitive, it was very bulky.

I would much prefer a battery, and not a mains "aid"; it could then be used at the talkies, and elsewhere. I suggest the use of midget valves and components and a tone control (for some deaf people are worse on the lower frequencies, whilst others are more affected on the higher frequencies). A midget output transformer (if such is manufactured) would be an advantage, also midget headphones, or a single midget earpiece such as is now usually employed with non-valve aids. Such earpieces generally are of very low resistance. There is also trouble with whistling unless the earpiece (or headphones) is fitted with a nipple to fit into the channel of the ear. Background noise should be as low as possible. Would it be possible to fit a Lieber oscillator for bone conduction? It gives a much purer tone than headphones. A volume control is essential to suit varying degrees of deafness. The smaller and more compact the "aid," the better. If the "mike" could be operated from the same source as the valves it would be a great advantage—a midget two-volt accumulator.—"ANOTHER SOCIAL EXILE" (Hoylake).

SIR,—In your issue of Feb. 5th you published a letter from "Social Exile" re an amplifier for the deaf. As another "Social Exile" who is so deaf that even the loud-speaker is unheard, and who can only carry on a conversation with difficulty by the aid of a carbon mike, 3-volt battery, and headphone, I am very anxious to see an article such as he suggests.

It seems to me that what is needed is an aid using three or four of the miniature valves now on the market and which use so small an amount of H.T. I was told of such an apparatus recently which uses four valves in parallel and is very good. I do not know what form of mike was included, but I do know that £25 was the cost! It does seem iniquitous that the necessities of the infirm should be so costly and out of the reach of most, especially having regard to the actual cost of components. My own deafness is of recent happening and has been a terrible handicap both in social and business life—in fact, I am finding that people are apt to shun one owing to the difficulty of making one hear. I have made numerous enquiries as to "mikes" and circuits of suitable amplifiers, but have met with discouragement, and, in one or two cases, with absolute discourtesy for having dared to enquire. So, Mr. Editor, please give us something

on which we can work.—"ANOTHER SOCIAL EXILE" (Gidea Park).

[We hope to publish an article on the subject in the near future.—Ed.]

### Dry-battery Symbols

SIR,—May I be permitted to correct several errors that your proof-readers missed in recent numbers of PRACTICAL AND AMATEUR WIRELESS? In the December 28th, 1935, issue, pages 484 and 485, in the theoretical diagram of Figs. 2 and 3 the draughtsman has transposed the plus and minus symbols of the dry battery.

Also the same error has occurred in the theoretical sketch accompanying "Test Engineer's" letter published on page 714, of the February 15th, 1936, issue, and again in Fig. 3 on page 727, of the February 22nd, 1936, number. The above are only minor points but, if uncorrected, they might confuse some readers.—DONALD W. ALDOUS (Ilford, Essex).

[We take it that our correspondent is trying to be facetious, since the battery terminals are clearly and correctly marked as to polarity. There can thus be no possibility of confusion in the minds of readers.—Ed.]

### An Encouraging S.W. Log

SIR,—In the summer of 1934 I constructed the Home Made Coil Two, a short-wave receiver which was described in the July 14th issue of *Amateur Wireless* of that year. This receiver has been giving splendid results ever since the date of construction, and with it I have logged many transmissions and received over 100 verifications of reception.

During the past few months the following stations have been received at good headphone strength:—

- W1XAL, W2XAD, W2XAF, W1XK, W2XE, W3XAL, W3XAU, W8XK, W8XAL, W4XB, W9XF, XECC, TIGPH, TPG, TIEP, TIRCC, COCD, COCH, COCO, CO9GC, HIZ, HI4D, HI4V, HRN, HIL, HP5B, VP3MR, HJ1ABB, HJ1ABE, HJ1ABG, HJ1ABJ, HJ2ABD, HJ3ABH, HJ4ABA, HJ4ABB, HJ4ABC, HJ4ABE, HJ5ABC, HJ4ABL, YV2RC, YV4RC, YV1ORSC, YV8RB, YV5RMO, YV12RM, YV6RV, YVQ, PRF5, PRA8, CRCX, VE9HX, VQ7LO, VUB, RW59, PMN, JVN, JVM, JVP, JNJ, JVS, VK2ME, VK3LR.

I have also picked up the new station at Madrid—the transmitter of Philips-Iberica. I received a card confirming reception of this station, but no details were given as to wavelength or call-sign. The power, however, is stated to be 600 watts, and the address is given as Box 643, Madrid.

I enjoy reading the articles in the Short-Wave Section, and would very much like to see this section considerably extended.—B. W. CASTLE (Boscombe).

### Back Numbers Wanted

SIR,—I should be very much obliged if any reader could supply me (on loan) with a copy of *Amateur Wireless* containing the wiring diagram of "Cosmic 3," or the "Telsen Triple 3," which was published about three years ago.—T. F. JONES, "Hereford House," over 135, High Street, Lye, Stourbridge.



SIR,—I shall be glad if any reader could oblige me with a copy of PRACTICAL AND AMATEUR WIRELESS, dated October 27th, 1934, on loan.—ALEX MILL, 31, Wilton St., Belfast.

**A Powerful Amplifier Wanted**

SIR,—In the issue of PRACTICAL AND AMATEUR WIRELESS dated January 26th, 1935, on page 667, is published a "Two-in-One Push-Pull Amplifier" for a battery receiver. May I suggest you give us an A.C. version using "Ferranti" input and output transformers to give an undistorted output of 5-6 watts.

If the amplifier had its own power pack same could be attached to many of your interesting receivers when a larger output was desired. I am sure an amplifier of this description would appeal to many of your readers.

I should use the amplifier with your £5 A.C. 3 superhet., which has given entire satisfaction.—B. ALDRED (Bolton).

**A Good Log of U.S.A. Amateurs**

SIR,—In the recent issue of PRACTICAL AND AMATEUR WIRELESS of December 28th, you published a letter of mine concerning the one-valve short-wave set which was described in your journal of September 14th, 1935. I have now a three-valve set which I have constructed. The set is of the simple detector and two L.F. type built on a metal chassis, and has bandspread tuning. I append my log of American amateurs I have heard, all at good loud-speaker strength.

VOII, W4CDG, W2ELO, W1FD, W2BSD, W3BOS, W1BR, W1AKZ, W1SA, W2CFU, W2OJ, W4DLH, W3BSH, W2GDU, W2FAR, W1HYK, W2GFH, W1MX, W1CRW, W1QM, W1BIC, W1MS, W3LN, W2EOY, W1AQM, W1ZD, W2EDW, W1GJX, W2BYB, W3CMY, W8DMY, W1CBD, W1CND, W9RIY, and W2HAU.—STANLEY H. DALE (West Hartlepool).

CUT THIS OUT EACH WEEK.

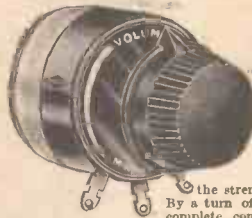
*Do you know*

- THAT when choke-coupling is employed in an H.F. stage the highest possible inductance should be used.
- THAT for the above reason the ordinary cheap type of reaction choke should not be employed in this position.
- THAT a low-value resistance in the reaction circuit will often improve performance and enable smoother reaction to be obtained.
- THAT a stranded aerial is much more effective if the individual strands are enamelled.
- THAT noisy short-wave reception can often be improved by insulating the earth lead.
- THAT a slow-motion device may now be obtained for use with ordinary types of variable components and insulated extension rods.
- THAT an ordinary type of meter may be used for measuring A.C. supplies by fitting a small metal-oxide rectifier.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL AND AMATEUR WIRELESS. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed to: The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

Owing to the rapid progress in the design of wireless apparatus and to our effort to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

**VITAL NEWS FOR EVERY KEEN CONSTRUCTOR**



**FROM A SHOUT TO A WHISPER**

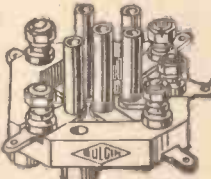
Bulgin Volume Controls will give perfect control over the strength of your signals. By a turn of the knob you have complete control over the whole range of audio frequencies. The type specified for Practical Wireless "Tutos" is a new component at an attractive price which will give excellent service.

Small 3-watt Volume Controls Linear Wire-wound with aquash plate contact, noiseless and non-wearing, in a moulded dustproof case complete with knob and dial. Soldering tags for connections.

List No.	Ohms.	Price	List No.	Ohms.	Price
VC. 41	500	2/6	VC. 45	10,000	3/-
VC. 42	1,000	2/6	VC. 46	25,000	3/-
VC. 43	2,000	2/6	VC. 47	50,000	3/-
VC. 44	5,000	2/6	VC. 48	100,000	3/-

**A PERFECT SETTING**

The main function of a valve-holder is to hold a valve and to make its connections. As valves are virtually the arteries of a set, valve-holders are most important components. Experience has shown that a great deal of the trouble in modern receivers may be traced to faulty or inefficient valve-holders.



Bulgin Short-Wave Valve-Holders are reliable, efficient and trouble-free. Built on "Frequentite" bases and having silver-plated contacts, they are extremely low-loss.

List No. S.W.21	5-pin	1/6d each.
List No. S.W.51	7-pin	2/3d each.

**FOR H.F. SEALED CHOKES**



The sealed type H.F. Choke combines efficiency with an attractive appearance. Hermetically sealed and screened with a spun metal case finished in frosted aluminium, it may be fixed to either base-board or chassis, a special lid giving concealed fixing. High inductance, low self capacity, and no peaking are the characteristics of this type.

List No. H.F.15	All-Wave Model.	Range 10-2,000m.	Price 5/- each.
List No. H.F.16	General Purpose Model.	Range 200-2,000m.	Price 2/3 each.
List No. H.F.19	Standard Model.	Range 180-2,000m.	Price 3/3 each.
List No. H.F.20	Super Model.	Range 150-2,500m.	Price 4/3 each.

**COILS FOR ALL STAGES**

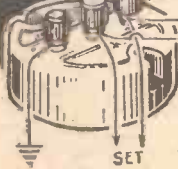


Modern dual wave circuits need Screened Coils of high efficiency and low losses—coils with negligible fields and of low price. There is a standard Bulgin Coil to suit every stage in any type of set. Designers know their worth. All the most efficient modern circuits use Bulgin High Efficiency Coils.

Screened Multi-Coil Aerial Tuning covering 200-500m. and 1,000-2,000m. with aerial coupling low resistance grid and reaction for use if desired.

List No. C.6	Price 4/6 each.
Tuned Grid. An efficient screened tuned grid coil with reaction winding. Range 200-500m. and 1,000-2,000m.	List No. C.8. Price 4/9 each.
Screened Band Pass, a pair forming one unit. Coupling windings and optional top coupling 9 kc/s band.	List No. C.9. 4/3 each.

**FOR INTERFERENCE SUPPRESSORS**



A troublesome background of mains-borne interference caused by electrical apparatus such as motors, vacuum-cleaners, electric irons, signs and flashers, etc., can be suppressed simply and easily. A small inconspicuous Suppressor Unit will, except in very rare cases, by-pass interference before it reaches the set.

The Interference Suppressor Unit shown above may be mounted inside or near the set in any advisable position. It is well insulated and will take A.C. or D.C. 250v. max. Safe and shock-proof.

List No. A.49. 2/6 each. A unit to fit between wall-sockets and apparatus plug is often more convenient, and the Interference Suppressor Adaptor fits all standard 2-pin 5A sockets, for A.C. or D.C. 250v. max. List No. P.50. 5/6 each.

**15-2,000 METRES**

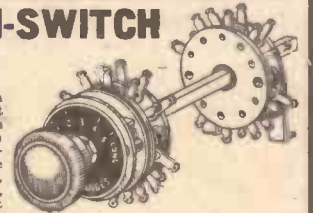


Now it is possible to build a set covering wave-lengths of from 15 to 2,000m. at comparatively low cost.

In the Bulgin Four Range Tuning Coils two coils are used each subdivided into separately screened parts and mounted on a moulded "Micro-loss" base with clearly marked tags for connection. These Bulgin Coils represent the latest development in Radio, unequalled in design, they

and are of superlative efficiency. Unequalled in design, they bring 1937 technique into 1936. List No. C.52 Aerial Coil } 8/9 each. List No. C.53 Oscillator Coil

**MULTI-SWITCH 5-WAY**



The Bulgin positive contact Multi-Way Switch for all modern wave-change purposes and all-wave working has five positions for two, four, six or eight poles and edge on self cleaning contacts. Any number of contact units may be used on the one rotating shaft.

<b>DRIVE-LOCATOR UNITS</b>	With 6 in. shaft.
List No. S.150	2/9 each
	With 9 in. shaft.
List No. S.151	3/- each.
	With 12 in. shaft.
List No. S.152	3/3 each.

<b>CONTACT UNITS</b>	2 pole 5-way:
With fixing bracket	List No. S.153. 2/9 each
Without fixing bracket	List No. S.154. 2/6 each

<b>STOCK ASSEMBLIES.</b>	
Drive and two sections	List No. S.122. 8/-
Drive and three sections	List No. S.155. 11/-
Drive and four sections	List No. S.156. 13/9

ADVT. OF A. F. BULGIN & CO. LTD., ABBEY ROAD, Showrooms: 64, Holborn Viaduct, London, E.C.1.

*B.F.*



**IT PAYS TO BUY THE BEST**

**WIDE VISION PRECISION DIAL.**

Built particularly for Short Wave tuning purposes where accuracy and smoothness of movement are essential. Free from backlash with 22:1 slow-motion ratio.

No. 973. Price 10/6d.



**SHORT WAVE H.F. CHOKE.**

Eddystone patent design with no metal or shorted wire loop at ends to cause losses. Greatest efficiency, small size and light weight for mounting in wiring.

No. 1010. 5-180 metres. Price 2/-.

**STRATTON & CO., LTD.**  
Bromsgrove Street, BIRMINGHAM.  
London Service Depot: Webb's Radio Stores, 14, Bobo Street, Oxford Street, W.1.

**EDDYSTONE**  
SHORT WAVE COMPONENTS

**ELECTRADIX BARGAINS**



The **DIX-MIPANTA**. This is a wonderfully versatile pocket moving-iron multi-range meter for service on A.C. jobs. No projecting terminals. THREE ranges of volts: 0-7.5, 0-150, 0-300. Used for MILLIAMPS reads: 0-124 m/a and 0.75 m/a. In black bakelite case, 2 1/2 in. by 2 1/2 in.

**19/6**  
**X-RAY VACUUM DISCHARGE TUBES,**  
10/- Brand New Govern-

ment Hospital Surplus, 7/2 dia. bulb. Big solid Tungsten electrodes. Emission guaranteed. COST £5, SALE 10/-.

**LIGHT AND RAY CELLS.**—Selenium Raycraft, 21/-; Kingston, 15/-; Raycraft outfit with relay and amplifier, 45/-; Photo-Cells, for sound on Film, Television and Ray work, B.T.P., 15/-; R.O.A. 25/-; G.E.C., Angle Prisms, mounted in carrier, 5/6; Micrometer adjusters for lens, 1/-; Eyepieces with prism and



**COMPONENTS TESTED IN OUR NEW LABORATORY**

**S.W. L. Review**

AN interesting review has been prepared and is to be issued monthly in the interests of listeners. The publication is issued by the British Short-wave League and costs 6d. The first issue is full of interesting information concerning short-wave stations at home and abroad, and gives details on the acquisition of GSL's, identification signals and slogans, and a "black list" of stations from whom confirmations cannot be obtained. Subscription is 6s. per year, or 3s. per half-year.

**Bulgin Suppressor-Adaptor**

TO overcome the difficulty of arranging for an interference-suppressing device for each piece of apparatus which may be used in



The new Bulgin interference-suppressing unit for use direct at the mains plug.

the home, the neat adaptor shown herewith may be employed. This is provided with two pins spaced to the standard 5-amp. spacing on one side, and immediately opposite there are two standard 5-amp. sockets. Thus, if the device is plugged into a mains socket any apparatus fitted with a two-pin plug may be inserted in the device and will be automatically joined to the mains as well as to the suppressing circuit included inside the bakelite case. An insulated terminal is mounted, as shown, for a separate earth connection, and thus the device may be left permanently connected to the mains socket and any apparatus used on the plug becomes automatically fitted with the suppressor. This consists of two fixed condensers having capacities of .2 mfd. connected in series across the mains plugs, with the junction point earthed, and the condensers are of the type designed for working on high voltages and may be relied upon not to break down in spite of the normal surges which may be experienced when inductive apparatus is joined to the mains. With the exception of the two pins, the entire assembly is insulated and shock-proof, and the price is 5s. 6d.

**A Lead-In Insulator**

MANY amateurs are content to drill through the window frame and pass an insulated wire through the hole for connection direct to the receiver. Such a scheme is quite sound for use on the ordinary broadcast wavelengths, provided



A double-cone insulator for use especially with S-W and transmitting apparatus.

the wood is dry and that the insulation is maintained. On short waves, however, and also for transmission purposes a much higher degree of insulation is required and, in addition, a large leakage path must be provided for the maintenance of the insulation during damp conditions. In the Raymart insulator shown on this page a central conducting rod is held in a glazed vitreous insulator formed in the shape of a double cone, and thus, with a small hole drilled to clear the conducting rod, the two cones may be clamped on either side of the window or wall to provide the necessary insulation. When the glass pane of the window is employed for the purpose, of course, the degree of insulation is improved. With a single cone at each end the price is 1s. 3d., and for the double-coned pattern, the price is 1s. 9d.

**New Magnavox Speaker**

SOMETHING entirely new in loud-speakers is announced from the Benjamin Electric Company, makers of the Magnavox loud-speaker. In the new model two speech coils are employed and it is claimed that one speech coil functions in the normal manner, but the other functions particularly well at the higher frequencies where the normal mass of the cone prevents good response. Fitted with a 9 in. cone, the speaker is at present only available with an energised magnet system, but we hope to obtain a permanent magnet model for test purposes and give a detailed report in a later issue.

**Hivac S.W. Valves**

THREE valves, designed especially for short-wave work, are now available in the Hivac range. These are known as the D.210 S.W., S.G.220 S.W., and P.X.230 S.W., and are all fitted with frequentite bases. The main characteristics of the valves are as follow:—  
D210 S.W.—Filament .1 amp. Impedance 12,000 ohms. Amplification factor 16. Slope 1.35 m/A V. Price 5s. 6d.  
S.G.220 S.W.—Filament .2 amps. Impedance 333,000 ohms. Amplification factor 500. Slope 1.5 m/A V. Price 12s. 6d.  
PS.230 S.W.—Filament .3 amp. Impedance 1,850 ohms. Amplification factor 6.5. Slope 3.5 m/A V. Price 12s.

**LATHE-WORK FOR AMATEURS**

by F. J. CANN

1/- or 1/2 by post from

Geo. Neunes, Ltd., 8-11, Southampton Street, Strand, W.C.2.



**REPLIES IN BRIEF**

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

**G. T. (Scunthorpe).** You can avoid the difficulty by fitting another switch so that H.T. may be switched off first. It is not, however, essential to do this.

**E. B. (Dewsbury).** As you will see, the subject of an A.C. charger was dealt with last week.

**R. C. S. (Clapham Park).** You could use the amplifier in the manner outlined by you, but as you already employ 2 L.F. stages we do not recommend the addition, but would suggest rather that you build a good H.F. amplifier—for instance, the Add-on H.F. Unit described in our issue dated January 25th last.

**Bath Forum (Newport, Mon.).** You can obtain additional coils for the wavelengths mentioned from B.T.S., whose advertisement appears in this issue.

**J. L. (Parkstone).** It is possible to adopt the scheme mentioned, but special precautions are necessary. Further details are required, especially of the receiver with which the units are to be used.

**G. H. (Glasgow).** Messrs. Peto-Scott can supply the set ready made up.

**L. O. (Refford).** We could not supply you with a print to use exactly the parts listed by you. We can only guarantee results when you duplicate the original receiver and thus use the original parts.

**C. E. P. (Coventry).** The valves are unsuitable for Mr. Camm's new receiver.

**R. J. J. (Rhyd).** Messrs. Paroussi can undertake the metal work. The address is 10, Featherstone Buildings, London, W.C.1.

**S. F. E. (Bootle).** We regret that we have no blueprints of receivers using the coil in question. Perhaps Messrs. Varley may be able to assist you.

**H. B. (Evesham).** The coils may be obtainable from one of the Surplus manufacturers who advertise in our pages, but we regret that we cannot insert an advertisement on your behalf in this particular case.

**C. K. (Liverpool).** We suggest modern iron-cored coils and you can select any well-known make. The advertisements in our pages will no doubt be of assistance to you. We cannot recommend any individual maker, but circuit diagrams are now obtainable with most modern components and it should not be difficult to incorporate the coils in your set.

**H. W. (Derby).** We have no set of the type mentioned, and do not think you could construct one for £4. We suggest you build the Silver Souvenir, or the £4 Superhet 4 and add a short-wave converter to this.

**J. W. N. (Kirkby-in-Ash).** We regret that we cannot give complete coil winding data of the type requested. The subject has been covered in various articles.

**F. W. (G.P.O., Bristol).** There is no book, so far as we are aware, which deals with the subjects mentioned.

**W. T. R. (Burnham-on-Crouch).** Your eliminator may be responsible and before carrying out any further tests we advise you to try the receiver with a dry-battery.

**J. R. (Monkstown).** We do not think there is any book published which deals with the subject mentioned. We do not advise you to undertake transmitting experiments without first applying for a licence.

**A. F. M. (Kenton).** The crystal may be obtained for 6d. from Electradix Radios, 218, Upper Thames Street, London, E.C.

**R. J. P. (Old Windsor).** We suggest one of the super one-valvers given in our issue dated February 9th last.

**A. F. (Mair-of-Ord).** Blueprint WM.399 may be of use to you, although we cannot give complete information without further details concerning the power required, etc.

**W. W. (Blackheath).** You may be using the pick-up in the wrong manner, and it would appear that the valve is not biased. Can you give further details?

**A. E. N. (Sheffield).** We do not think it would be worth while converting the receiver and your mains unit would not be suitable. A much higher H.T. voltage is required for an all-mains set, all-mains valves requiring 200 to 250 volts H.T.

**J. P. (Southend-on-Sea).** We do not advise the stripping-down of the transformer. It would be better to use it as it stands, and use series resistances to lower the voltage. Thus, should you decide at some future date to increase the available power, it will only be necessary to modify the resistances.

**P. H. G. (Stanford-le-Hope).** You must use more H.T. in order to obtain good quality reproduction. We cannot recommend the type of set mentioned by you except as a "stunt," and suggest you build a standard receiver.

**N. D. (South Marrow).** Can you ascertain whether it is the set which is responsible, or the eliminator? We suggest you try a dry battery with the set in order to check the eliminator.

**Experience Teaches us—**

We all learn a great deal from experience, and most of us are wise enough to act upon the experience of others who in a sense we look to as our "tutors."

Mr. F. J. Camm has had a wide experience in the use of Clix perfect contact components, hence their again being specified for both The "TUTOR" and the "S/W CONVERTER" described in this issue.

All the following are Specified

**CLIX VALVEHOLDERS.**

Type V.1. 4-pin 8d. 5-pin 9d.

Type V.5. 4-pin (Ceramic base) 10d.

**CLIX SOCKET STRIPS.**

(D) With terminals A. E. or L.S. 6d.

(C) With terminals L.S. and P.U. 8d.

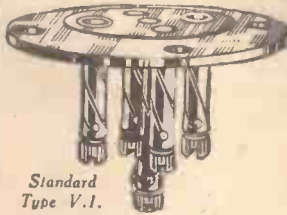
**CLIX WANDER PLUGS.**

For H.T., G.B., and general Plug and Socket work 1½d.

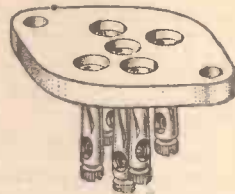
**CLIX SPADE TERMINALS.**

Large 2d. Small 1½d. each.

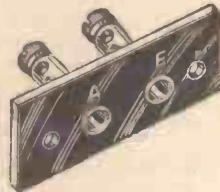
FOLDER "N" FREE ON REQUEST



Standard Type V.1.



Low-loss Ceramic Type V.5.



**LECTRO LINX LIMITED, CLIX**  
79a, ROCHESTER ROW, LONDON, S.W.1

**BELLING-LEE**  
FOR EVERY RADIO CONNECTION

**"TUTOR"**

**F. J. CAMM'S**  
Components specified by the designer

	s.	d.
Three Socket Strips at 9d.	2	3
Seven Wander Plugs at 1½d.	10	½
Two Spade Terminals at 2d.	4	
	3	5½

**Detailed Specification**

Socket Strips, No. 1047.

Complete with plugs. A/E. L.S. P.U.

"Bow-Spring" Wander Plugs, No. 1112.

H.T.—; H.T.1;  
H.T.2; G.B.+; G.B.1;  
G.B.2; G.B.3.

Spade Terminals, No. 1025.

L.T.+; L.T.—

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JOB WELL DONE

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If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.



**SPECIAL NOTE**

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

- (1) Supply circuit diagrams of complete multi-valve receivers.
- (2) Suggest alterations or modifications of receivers described in our contemporaries.
- (3) Suggest alterations or modifications to commercial receivers.
- (4) Answer queries over the telephone.
- (5) Grant interviews to querists.

Please note also, that queries must be limited to two per reader, and all sketches and drawings which are sent to us should bear the name and address of the sender.

**Erratic Tuning**

"I have built the £4 Superhet Four, but am rather puzzled by the behaviour of the set, which is, in all other respects, my ideal of what a set should be. When tuning in on one evening I find that a certain dial reading will give me, say, London, but although this may hold for even two or three nights, there comes a time when I have to tune perhaps four or even five degrees lower, and sometimes higher, to get the same station. There are no loose wires, and my aerial is suspended so that it cannot sway or come near the walls. Can you suggest the probable cause of this defect, or give me any indication upon which to work?"—R. T. (Birmingham).

IN view of the nature of a superhet circuit, namely, that the station selection is obtained by virtue of a frequency difference (set by the design of condenser and coils) which results in a beat note having the frequency to which the I.F. transformers are tuned, it is practically impossible for any defective component to produce erratic tuning points. You will see that if the oscillator coil, for instance, had a loose winding, the tuning would not be consistent, and if out of tune with the desired station no signal could be heard. Any adjustment to tune this section would put out the aerial tuning circuit and again the station would not be heard. We therefore feel practically certain that your trouble may be traced to the fact that the locking screw which retains the tuning dial on the main condenser spindle is loose. Thus, although all the trimmers are correctly adjusted, there is sufficient play in the spindle to enable the dial to turn without turning the condenser plates and it is this which is causing the variation in tuning.

**Using a Frame Aerial**

"I have built the £5 Superhet Three, which has been working for a long time in good condition, but I have now moved into a flat and cannot put up an outside aerial. Can you give me details of a frame aerial to use with this set under my new circumstances?"—G. T. (Newcastle).

IT must be remembered that a frame aerial is tuned and takes the place of the first tuned circuit in a receiver. Consequently it cannot be substituted in any receiver employing ganged tuning, in view of the fact that it will not match the remaining tuned circuits and would therefore have to be tuned by a separate condenser. Moreover, there is no advantage to be gained by using this tuned aerial system in the present case, and the new conditions would best be met by arranging an aerial round the wall, using a Pix or similar arrangement which may be stuck to the wall in an inconspicuous manner. Alternatively, if a much higher degree of efficiency is required, special spacing components may be obtained to fit to the picture-rail and a substantial aerial wire may thus be suspended round the walls, keeping the wire at least one foot from the wall, and maintaining a high degree of insulation throughout. It may be found under these circumstances that a similar wire arranged round the skirting board and connected only to the earth terminal (not to any earthed body) will result in a better performance. It will, of course, be acting as a counterpoise.

**Circuit Tests**

"I am in the unfortunate position at the moment of having no testing instruments, although I intend to make up a multi-meter in the near future. I have made a three-valve set, using a simple detector 2-L.F. combination, but only very faint signals can be obtained. I have replaced the tuning coil, but with no improvement. Can you tell me what is wrong or how to trace the cause of the trouble?"—B. O. (St. Helens).

IF the applied voltages are correct, the trouble must be due to defective valves or L.F. couplings. The simplest test is to connect the anode of the detector stage to

the anode of the second valve, thus cutting out the first L.F. coupling. If signals are then almost as good as with the three valves, you will know that either the second valve or the coupling is faulty, and by changing these components with those in the next stage can locate the faulty part. If, however, hardly any signals are obtained when this connection is adopted, it will indicate a faulty L.F. coupling between the second and third valves or a faulty output valve. Again, a change round of the part will assist in tracing the defective component.

**A D.C. Eliminator**

"I have a home-made D.C. eliminator made for working on 150 volt mains supply D.C. I now wish to use same on 240 volt supply. To allow for the drop of 90 volts (i.e. 240 to 150 volts), have I to put a resistance in series with leads from mains plug? If this is so, will you please inform me what value and type of resistance I must use."—C. C. C. (Leyton, E.10).

UNLESS the components used in the eliminator have been chosen for working on a low voltage such as 150 volts and will not stand the application of a higher voltage, the necessary additional resistance should not be included on the mains side of the unit, but in the H.T. positive output lead. The value of the resistance will have to be chosen according to the total anode current which is flowing, and then by including a further large-capacity condenser between this resistance and earth, additional smoothing will be incorporated which may be found desirable in this particular case. To ascertain the value of the resistance, 90 must be divided by the number of milliamps and the answer multiplied by 1,000. Then, in order to ascertain the wattage rating of the resistance multiply 90 by the number of milliamps and then divide the answer by 1,000.

**One-valve Receiver**

"I send a sketch of a one-valve short-wave set and I would like to know what voltage to use, and whether it would be suitable for short waves. The valve is a low-frequency-detector type."—L. S. H. (Bedford).

THE only modification which should be made to the set to render it suitable for short-wave purposes is to connect the grid leak between grid and the L.T. positive terminal on the valve-holder. As an improvement, you can fit a potentiometer across the L.T. terminals and connect the grid leak to the arm of this in order to find the most suitable bias point to give smooth reaction control. The H.T. voltage should generally be between 40 and 80 volts, and must depend upon the valve and the reaction circuit. If too low, no reaction will be obtainable, whilst if too high, the set will burst into oscillation before a suitable build-up in signal strength has been obtained.

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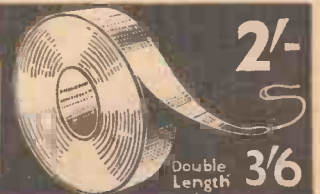
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# RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

## EXETER AND DISTRICT WIRELESS SOCIETY

ON Monday, March 2nd, Mr. W. B. Sydenham (G5SY) gave a most interesting talk on 5-metre work. He dealt with the properties of 5-metre wavelengths, and stated that it has now been found that 5-metre waves do "bend." The chances are that in a year or two, 5-metre contacts may be established over great distances, although they may only last for a few moments.

The apparatus demonstrated by Mr. Sydenham—a trans-celver and a portable receiver—showed his exceptional skill in building compact and portable units. Many gadgets had been made from inexpensive components. Details of membership can be obtained from Hon. Sec., W. J. Ching, 9, Sivel Place, Heavitree, Exeter.

## BRADFORD SHORT-WAVE CLUB

THE above Club had a very interesting evening on Friday, March 6th, when three or four of the members brought their sets along, and gave demonstrations on their receiving abilities. Mr. A. E. Shaw, "Tuner," of the "Yorkshire Observer," has promised to come along on Friday, March 27th, and give us a talk on "Short-wave Reception and Equipment." We shall be pleased to welcome anyone who is interested. The meetings are now held at Bradford Moor Council School, Leeds Road, Bradford, every Friday evening. Hon. Sec., G. Walker, 33, Napier Road, Thornbury, Bradford, Yorks.

## THE CROYDON RADIO SOCIETY

"AMPHION," music critic of "The Croydon Advertiser," lectured on "Music Pulled to Pieces" for the meeting in St. Peter's Hall, S. Croydon, on Tuesday, February 4th. The lecture was full of interest for the music lover, and particularly fascinating was the description of different devices which the composer could use in composing a musical piece. For instance, he could use augmentation and diminution of a theme, the former meaning that the theme was played at twice normal length, while the latter was the opposite. Then there was inversion, and also the device of canon, where a theme was used to accompany itself. Examples on the society's piano and records were made frequently. "Variations," said "Amphion," "lay at the root of the composer's art," and he discussed the applications. Finally, he played the overture to "Hansel and Gretel," containing all the devices he had mentioned, and one could marvel at the ingenious way the composer had blended the piece together. Many other aspects of music composition were discussed, but "Amphion" insisted that it was wrong to think a piece was good if merely technically correct. Design or form added to the beauty of a composition, which, if of any length indeed, must have a well-established form.

Always one of the season's most popular events, the Croydon Radio Society's loudspeaker night was no exception on March 3rd, in St. Peter's Hall, Ledbury Road, S. Croydon. A guest lecturer was Mr. G. S. Taylor, who talked for ten minutes on various difficulties in designing the ideal speaker.

Tests brought out Mr. Delves-Broughton's homemade model, as well as Mr. Morlaunt's mystery model, recently demonstrated. Mr. M. G. Firmin's dual unit, having specially matched speakers, caused much comment, and Mr. Betteridge's instrument, made from spare Baker parts, also put up a good performance, as did Mr. P. C. Clarke's dual Piego. On Tuesday, March 24th, Mr. L. C. Irvine demonstrates his latest receiver.

## THE RADIO PHYSICAL AND TELEVISION SOCIETY

"GLASS Blowing," an art closely allied with radio, was the subject of a fascinating lecture with demonstrations by Mr. J. A. Lemon, at the meeting of this Society held on Friday, February 28th. The chemical characteristics of glass were described, and samples of several types of glass were shown. Silica which is used for large transmitting "bottles" is of such a small coefficient of expansion that when the lecturer immersed a red-hot rod of this material in cold water it remained unchanged, whereas a similar stick of glass was completely cracked when treated in the same manner. Mr. Lemon constructed various pieces of glass apparatus starting with a simple U-bend and various bulbs, while he constructed several pieces of intricate apparatus with an evacuating pump.

On Friday, March 20th, at 8 p.m., Mr. G. Parr, of Edlswan Radio, is to lecture on "Cathode Ray Tubes and their application to Radio and Television." A large attendance is expected at this meeting, and we welcome all readers of PRACTICAL AND AMATEUR WIRELESS. Headquarters are at 72a, North End Road (off Talgarth Road), West Kensington.

Further details of meetings, which include a Morse class and a beginner's course, may be obtained from the Hon. Sec., M. E. Arnold, 12, Nassau Road, Barnes, S.W.13.

## A SHORT-WAVE CLUB FOR WELLINGBOROUGH!

A SOCIETY of short-wave radio and television enthusiasts is being formed in Wellingborough with the object of getting together all those interested

# OUR FREE CATALOGUE SERVICE

## "GOLSTONE" COMPONENTS

THE latest list of the well-known "Golstone" radio components comprises fifty-six well illustrated pages, and will be found extremely useful to all radio enthusiasts.

Nearly 300 items are enumerated in the index, which gives some idea of the comprehensive range covered. Practically all the lines listed are made in England, the few that are not being clearly designated foreign. Devices for the suppression of man-made static have been given much space, notably patent air-spaced metal-screened downleads as recommended by the Post Office authorities and installed by both the B.B.C. and Home and Dominion Governments. The list also includes a wide range of iron-cored tuning-coils, chokes, fixed condensers, switches, and general electrical accessories, including meters of various types. This comprehensive list is issued by Ward and Goldstone, Ltd., Frederick Road, Pendleton, Manchester.

## BULGIN RADIO PRODUCTS

EVERYTHING the constructor is likely to require in the way of radio components is listed in the latest handy one-hundred-page catalogue recently issued by A. F. Bulgin and Co., Ltd. Specialisation in

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the field of radio components for over fifteen years has resulted in the fine range of high-quality components shown in this well-illustrated catalogue. Several types of toggle switches for mains use, and semi-rotary switches for various purposes are listed. Also included are volume controls, resistances, fixed condensers in all capacities, H.F. and L.F. chokes, filters and tone controls, screened tuning coils, valve-holders and adaptors, mains connectors, and measuring instruments. At the end of this useful catalogue is a technical manual which indicates clearly, with the help of diagrams, the methods of using Bulgin components in various circuits. The price of the complete catalogue and manual is threepence.

## NEW COSSOR SUPERHET

AN attractive leaflet is now available giving particulars of the new Cossor 7-stage battery superhet with class "B" output. Almost every refinement that can be embodied in a mains receiver has been worked into the specification of this model. It has a moving-coil speaker, tuning control with dial calibrated in wavelengths, and with a detachable station nameplate. In its well-finished cabinet, this receiver, which is known as model 376B, costs only £9 10s.

## RADIO CLUBS & SOCIETIES (Continued)

in the hobby of radio. Membership of this society is open to all, and both expert and novice are equally welcomed. It is hoped that sufficient members will be forthcoming to enable the society to have its own club room complete with receiving and transmitting apparatus, this being constructed and operated by the members. The membership fee is only a small one and can be paid at the convenience of the member.

An inaugural meeting was held in Room 2 at the "Granville" Hotel on Monday, March 9th, commencing at 7.45 p.m. All interested readers in Wellingborough and the surrounding district were heartily invited to attend.

Further particulars can be obtained from L. F. Parker (G5LP), 16, High Street, Wellingborough.

## SHORT-WAVE CLUB FOR WEST BYFLEET!

WILL short-wave enthusiasts in the West Byfleet district please note that a few local enthusiasts are about to form a short-wave club. We are fortunate in so far as Transmitter G5LN has promised to co-operate with us when we get started. Will any reader interested please write to Mr. F. W. A. Smeeth, 2, Scotland Cottages, West Byfleet, Surrey?

## BOOK RECEIVED

THE SUPERHETERODYNE RECEIVER. By A. T. Witts, A.M.I.E.E. Second Edition, 160 pp. Price 3s. 6d. Published by Sir Isaac Pitman and Sons, Ltd.

IN order to bring this interesting book up to date, the author has had to revise many of the features which were originally included, and certain of the receivers which were originally given as illustrations have now been superseded by more modern commercial receivers. Amongst the new developments which are explained may be mentioned variable selectivity, all-wave receivers, car radio, automatic-tuning correction, etc. Several of the sections have now been amplified, and the book covers every aspect of the modern superheterodyne receiver, including a valuable chapter on the maintenance or servicing of such apparatus. There are eighty-three illustrations, and the chapter on Automatic-Volume Control alone is illustrated with no fewer than sixteen diagrams, showing all the possible variations of this circuit feature.



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(Continued in column 2)



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 "Practical Wireless" at 4d., "Amateur Wireless" at 4d., "Practical Mechanics" at 7d., and "Wireless Magazine" at 1/3d, post paid. Index letters "P.W." refer to "Practical Wireless" sets, "P.M." to "Practical Mechanics" sets, "A.W." refer to "Amateur Wireless" sets, and "W.M." to "Wireless Magazine" sets. Send (preferably) a postal order (stamps over sixpence unacceptable) to "Practical and Amateur Wireless" Blueprint Dept., Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

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S.G. Three (SG, D, Pen) A.C. ..	—	AW380
A.C. Triodyne (SG, D, Pen) A.C. ..	19.8.33	AW390
A.C. Pentaquester (H.F., Pen, D, Pen) A.C. ..	23.0.34	AW430
Mantovani A.C. Three (HF, Pen, D, Pen) A.C. ..	—	WM374
£15, 15s. 1936 A.C. Radiogram (HF, D, Pen) ..	Jan. '36	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen) ..	July '33	WM320
"W.M." A.C./D.C. Super Four ..	Feb. '35	WM382
Harris Jubilee Radiogram ..	May '35	WM386
SUPERHETS.		
Battery Sets. Blueprints, 1s. 6d. each.		
"W.M." Stenode ..	—	WM373
Modern Super Senior ..	—	WM375
Varsity Four ..	Oct. '35	WM395
Mains Sets : Blueprints, 1s. 6d. each.		
1934 A.C. Century Super A.C. ..	10.3.34	AW425
Heptode Super Three A.C. ..	May '34	WM359
"W.M." Radiogram Super A.C. ..	—	WM366
"W.M." Stenode A.C. ..	Sept. '34	WM370
1935 A.C. Stenode ..	Apr. '35	WM385
PORTABLES.		
Four-valve : Blueprints, 1s. 6d. each.		
Midget Class-B Portable (SG, D, LF, Class B) ..	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B) ..	1.7.33	AW393
Family Portable (HF, D, RC, Trans) ..	22.9.34	AW447
Two H.F. Portable (2 SG, D, QP21) ..	June '34	WM363
Tyers Portable (SG, D, 2 Trans) ..	Aug. '34	WM367
SHORT-WAVERS—Battery Operated.		
One-valve : Blueprints, 1s. each.		
S.W. One-valve converter (price 6d.) ..	—	AW329
S.W. One-valve for America ..	—	AW429
Roma Short-waver ..	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-short Battery Two (SGdet, Pen) ..	Feb. '36	WM402
Home-made Coll Two (D, Pen) ..	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans) ..	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen) ..	30.6.34	AW438
Experimenter's Short-waver ..	Jan. 19, '35	AW463
The Carrier Short-waver ..	July '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World Beater (HF Pen, D, RC, Trans) ..	—	AW436
Empire Short-waver (SG, D, RC, Trans) ..	—	WM313
Standard Four-valve Short-waver ..	Mar. '35	WM383
Superhet : Blueprint, 1s. 6d. ..	—	WM397
Simplified Short-wave Super ..	Nov. '35	WM397
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C. ..	—	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C. ..	Aug. '31	WM368
"W.M." Long-wave Converter ..	—	WM380
Three-valve : Blueprints, 1s. each.		
Emigrator (SG, D, Pen) A.C. ..	—	WM362
Four-valve : Blueprints, 1s. 6d. each.		
Gold Coaster (SG, D, RC, Trans) ..	—	WM292
A.C. ..	—	WM292
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) ..	Aug. '35	WM391
MISCELLANEOUS.		
Enthusiasts Power Amplifier (1/6 (1/6) ..	June '35	WM387
Listener's 5-watt A.C. Amplifier ..	—	WM398
Radio Unit (2v.) for WM392 (1s.) ..	Sept. '35	WM302
Harris Electrogram (battery amplifier) ..	Nov. '35	WM398
Do-Luxe Concert A.C. Electro-gram ..	Dec. '35	WM399
New style Short-wave Adapter (1/-) ..	Mar. '36	WM403
Trickle Charger (6d.) ..	June '35	WM388
Short-wave Adapter ..	Jan. 5, '35	AW462
Superhet, Converter ..	Dec. 1, '34	AW456
Superhet, Converter ..	Dec. 1, '34	AW457



Miscellaneous Advertisements

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RECEIVERS, COMPONENTS AND ACCESSORIES

Surplus, Clearance or Secondhand, etc.

PREMIER SUPPLY STORES

ALL previous bargains advertised are still available. Send 3d. for large illustrated catalogue including Bargain Supplement.

WORLD Famous Continental Valves, mains type, 4/6 each H.L., L.; screen grid; variable mu screen grid; 1, 3 and 4 watt A.C. output directly heated pentodes; 250-volt 60 m.a. full valve rectifiers, V.M.H.P., D.D.T., diode tetrodes; A.C., D.C. types, 20 volts, 0.18 amp., filaments; screen grid; variable mu screen grid; H., H.L., power and pentodes.

THE Following Types, 5/6 each: 350v. 120 m.a., full wave rectifiers, 500v. 120 m.a., full wave rectifiers, 24 watt indirectly heated pentodes.

2-VOLT H.F., L.F., 2/3; power, low consumption power, super power, 2/9; screen grid, variable mu screen grid, 5- or 4-pin pentodes, V.M.H.P., H.P.P., Class B, 5/-.

THE Following American Types, 4/6; 250, 210, 245, 47, 40, 24, 35, 51, 57, 58, 55, 37, 80, 6A7, 2A7, 27, 77, 78, 2A5, 281; all other American types, 6/6 each.

PREMIER Kit of Parts for 1 Valve 14/150 metres receiver or adaptor, complete with coils, chassis, and circuit, 12/6.

SPECIAL Offer. Bargain Parcels. Every parcel is amazing value, being genuinely worth several times its cost; available in 5/-, 10/-, 20/- Parcels.

LISSEN Ganged Bandpass Coils, set of 3, with integral switching, 6/11, or complete with 4v. chassis. Valveholders, 3-Gang Condenser and Drive, 14/6. Circuit supplied.

PREMIER SUPPLY STORES

20-22, High St., Clapham, S.W.4 (Phone: Macaulay 2381), and 105, Fleet St., E.C.4 (next door to Anderton's Hotel). Phone: Central 2833.

VAUXHALL.—Polar Midget 3-gang condensers, straight or superhet., 8/9; Polar full vision, horizontal or Arcuate dial and drives, 4/6.

VAUXHALL.—Polar station named scales, for horizontal dials, latest settings; 1/9 each.

VAUXHALL.—Flat, sheet aluminium, hard rolled, 18 gauge. 12in. x 12in., 2/6; 18 x 18, 5/-. Other sizes pro rata.

VAUXHALL.—Set manufacturers' surplus, skeleton type Westinghouse rectifiers, H.T.S., 9/6; H.T.9, H.T.10, 10/-; complete with fixing brackets; Westectors, W.4, W.X.6, 5/9.

VAUXHALL.—Erie Resistances and other well-known makes. 1 watt types, all values, 6d. each.

VAUXHALL.—T.O.C. electrolytic condensers, 8 mid. and 4 mid., 550 volt, 3/-; 500 volt, 2/6; 450 volt, 2/5.

VAUXHALL.—J.B. square plane dial and drive, large, oblong scale, bronze, complete with station named scale, 5/-.

VAUXHALL.—For full lists, previous issues, send postcard for lists, 3,000 bargains. Quite free.

VAUXHALL UTILITIES, 163a, Strand, W.C.2, over Denny's the Booksellers. Temple Bar 9338. Send postcard for lists, free.

MISCELLANEOUS

SUITABLE valves for each kit by well-known manufacturers included at the kit price to initial purchasers of one of our new low-priced home construction kits.

"AIT CUB," Short-wave, 19-55 metres, band-spread, 12/6. All-wave, 10-2,000 metres, 18/6. "Little Scout," short-wave bandspread III, 15-55 metres, 22/6. "Straight" Super III, 180-2,000 metres, 15/6. Short-wave adaptors, 10/6. Every kit complete with metal chassis and sundries. EVERY KIT WITH VALVES, a real double bargain; order early and secure. Cash or C.O.D. post 1/-. Enclose also 3d. stamps for complete component lists.

ANGLO AMERICAN RADIO DISTRIBUTING CORPORATION (Dept. 10), 1, Lower James Street, Piccadilly Circus, London, W.1.

DEMONSTRATION MODELS. Philips, Decca, K.-B. 1935 A.C. Superhets. 10 gm. models. Used few hours only. Bargains at 27 each, carriage paid. Dickens "Parkdale" Brook Holloway, Wollescote, Stourbridge.

BARGAINS!

"Practical Wireless" KITS

HALL MARK 3

ORIGINALLY £2:5:0 TO CLEAR 27/6

THE LAST FEW! Send your Order NOW for a Hall-Mark 3 Kit, as described in "Practical Wireless" Dec. 8th, 1934. One of the most successful of Mr. F. J. Camm's circuits.

FREE BLUEPRINT WITH KIT

Complete Kit of components, including Peto-Scott ready drilled Metaplex chassis, less valves and cabinet. Original price, 45/-, TO CLEAR 27/6 Cash or C.O.D. Carriage paid, or 5/- down and 5 monthly payments of 5/-.

If required, with set of 3 BRITISH valves, Cash or C.O.D. Carriage paid, £2 8s. 3d., or 10 monthly payments of 5/3.

Ready Assembled "Pr. W" KITS

We have a few Ready Assembled and Tested "Practical Wireless" Kits, including A.C. LEADER 3, SILVER SOUVENIR, ALL PENTODE 3. Full details of your requirements on request.

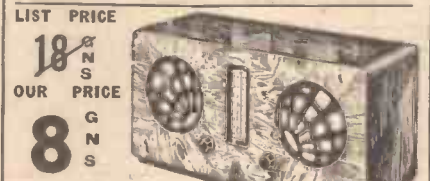
McMICHAEL 5-VALVE BATTERY



and 17 monthly payments of 10/9. LIST PRICE 16 GNS OUR PRICE 8 GNS

2 H.F. Stages, Detector, Driver and Class B Output. Moving Coil Speaker. Exceptional degree of selectivity. Long range. FINE VOLUME. Complete with all valves, H.T. battery and accumulator. Ready to play.

4-VALVE D.C. SUPERVOX



LIST PRICE 18 GNS OUR PRICE 8 GNS

GUARANTEED BRAND NEW. Twin Matched Moving-Coil Speakers. Selector Switch cuts out interference. Tone Control. Gramo Pick-up and External Speaker Connection. 2 S.G. High Frequency Valves, detector, corrected Pentode Output, Band Pass Tuning. Handsome Walnut Cabinet. For D.C. Mains 200-250 volts. Illuminated Wavelength Scale. Easy Terms: 7/6 down and 17 monthly payments of 10/9. A.C. Model. List Price, 18 Gns.; Our Price, 12 Gns. Or 15/- down and 17 monthly payments of 16/-. Please state voltage and cycles required.

NEW TIMES SALES CO. was first with Easy Terms in 1924. We can supply all Radio Accessories, Kits, Sets, Pick-ups, Mains Units and Speakers on the lowest terms. SEND US A LIST of your requirements and we will quote you per return. Orders over 10/- sent C.O.D., and Carriage charges paid (Gt. Britain ONLY).

New Times Sales Co

56, Pr. W. 11, LUDGATE HILL, LONDON, E.C.4. Dear Sirs; Please send me..... I enclose Cash/Deposit..... NAME..... ADDRESS..... Pr. W. 11.

BIRMINGHAM RADIOMART SHORT-WAVE SPECIALISTS

Proprietor, G5NI. Manager, G2AK. Staffed by experienced transmitting amateurs. Obviously we can serve you better.

CAUTION: Beware of coilforms, etc., moulded in cheap bakelite. Our coils and formers are guaranteed efficient.

4-PIN interchangeable short-wave coils; set 8. Cover 15-100 metres, latest ribbed former, 7/3.

1 1/2 IN. ribbed short-wave coil forms: valveholder type, lotos, 4-pin, 1/6. 6-pin, 1/9. Threaded for winding, 2d. extra.

UTILITY 8/6 microdisc dials, fitted famous micro-high reduction, only perfect short-wave dial, 3/11.

SHORT-WAVE H.F. chokes, 9d. Wireless World states: "Very efficient—100 to below 10 metres."

UTILITY microvariables 15, 40 mfd., 1/-; 100 mfd., 1/3; 465 kc/s litz wound I.F.'s, 5/6.

RADIOPHONE super ceramic insulated short-wave condensers, .00016, 3/6; series cap, 3/9.

CONTINENTAL A.C. valves, 4/6, VMPT, HPT, VMSG, AMSG, ACH, ACHL, PT4. Most American types, A.C. Pen., 5/6.

2V types, H.F. detector, L.F., 2/3; LP2, P2, 2/9; Supover, 3/3; VMPT, HPT, 5/6; Class B, 4/6; S.G., VMSG, 5/-.

BARGAIN parcel value 30/-, containing binocular HFC, 4 750v. test condensers, 6 resistances, 4 valveholders, .0003, .0005 variable, electrolytic condenser, etc., 5/-. Traders' parcel, £4/10/0 value, 10/-.

SPECIAL. Set Lissen 3-gang superhet coils, two Lissen I.F.'s, 3-gang superhet condenser; value 63/- for 10/-.

CABINETS. Climax horizontal set and speaker cabinets, 2/11. Vertical, 3/9. Part postage 6d. extra. Ekco chromium set stands, 12/6.

T ELSEN 7/6. Ace transformers made for leading company, boxed, 1/11.

B ALL-BEARING air-spaced condensers; World's finest manufacturers 4-gang, 3-gang superhet, 1/11.

N ON-INDUCTIVE condensers by leading makers, T.C.C., Dabiller, etc., 0.5, 0.25, 0.1, 0.02, 0.005, 3d.

A STOUNDING offer electrolytic condensers, 4+4 mfd. (separate) 500v., working, 1/6. 8+8 mfd., 3/6; 8+16 mfd., 3/11.

GENUINE 15/6 Frost potentiometers, wire-wound, tapered, 10,000 ganged to 50,000 ohms, 1/6.

LISSEN 2-gang coils, 12-2,000 metres, switched and screened, nothing else required to convert SG3 to all-wave, 12/6.

LISSEN 3-gang bandpass superhet coils, 4/6; 3-gang bandpass Tuned grid, 6/11. All with circuits.

A MBLION, 3/6; screened H.F. choke, 1/11; Iron-cored binocular, screened, 2/3. Climax binocular, 1/3. Telsen, 1/11.

UTILITY 2-gang .0005 Uniknob with large disc drive, 3/11. Ditto, single, with disc, 2/3.

LISSEN 30hy., 40 ma., chokes, 2/-; 20hy., 100 ma., 2/11. Lissen eliminator chokes, 1/3.

I GRANIC tapered potentiometers 1/2-meg., 1-meg. with 3-point switch, 2/-. Centralab 1-meg., 1/6.

2 GROSS roundhead woodscrews, assorted, 9d. Solder tags, 6d.; resincore solder, 9ft., 6d.

PUSHBACK connecting wire, ready tuned and sleeved, 6yds., 6d. Heavy, for heaters, 9d.

S SCREENED iron-cored selective dual-range coils, with reaction; circuit diagrams, 2/11.

N ON-INDUCTIVE tubulars, 1,500 v., 0.01, 0.02, 0.04, 0.05, 0.1, 6d.; 0.2, 0.25, 8d.; 0.5, 9d.

LISSEN 6-way battery leads, with plugs, 6d. Belling-Lee safety mains plug and socket, 6d.

T RANSFORMERS B.T.H. speaker; suit all moving coils, 2/11. Manufacturers push-pull, 1/11.

FUSES, Telsen 4-amp., 1-amp., 3-amp., 2d. Telsen 100 ma., 2d.

T ELSEN latest differentials, .003, 1/3; .00015, 1/- Radiogrand transformers, 2/9.

SPECIAL. Four assorted Telsen grid-leaks, 5d.; twelve various wire-ended resistances, 2/6.

MILLIAMMETERS: flush 2 1/2 in., 5/9; 2 1/2 in., 6/9. all ranges above 25 m.a., visual tuning, 6/9.

T.C.C. etc., bias electrolytics, 50 mfd., 50 v., 1/9; 25 mfd., 25 v., 1/3; 15 mfd., 100 v., 1/-; 6 mfd., 50 v., 6d.

RADIOMART

Order over 6/- post free. Enquirers must enclose stamp.

Catalogues; general catalogue gives hundreds of bargains; short-wave illustrated catalogue also gives diagram of efficient transmitter and receiver; each 1d. Pair 3d., post free.

THE SQUARE DEALERS

19, John Bright St., 22, Summer Row; mail-orders: 44, Holloway Head, Birmingham. Telephone: Midland 3254

NEW RECEIVERS, COMPONENTS AND ACCESSORIES

ALL-WAVE A.C. Five, £9/9/0. Novo Radio St. John Street, Newcastle-on-Tyne 1.

HULBERT for Quality Surplus Speakers. All Music Lovers should write for List of amazing bargains. Prices from 8/6 brand new. Made by best known British maker.—Hulbert, 6, Conduit Street, W.1.



# RADIO CLEARANCE

63, HIGH HOLBORN, W.C.1.

TEL.: HOLBORN 4631.

GENUINE SALE FOR 14 DAYS ONLY.

OPPORTUNITIES THAT OCCUR ONCE A YEAR ONLY:

**15/11** LISSEN SKYSCRAPER 3 CHASSIS. Less Valves, shop soiled. Built and Aerial tested.

**25/11** LISSEN SKYSCRAPER 3 CHASSIS. Complete with Valves, shop soiled. Built and Aerial tested.

**84/-** LISSEN 4 VALVE BAND PASS A.C. MAINS SET. Screen Grid, Detector, Pentode, Valve Rectification, Iron Core Coils, Band Pass tuned, fitted energised Moving Coil. A super bargain. List £0 15s. Brand new.

**70/-** LISSEN BAND PASS 3 BATTERY SETS. Complete in handsome Walnut Cabinets. Iron Core Coils, Band Pass tuned, P.M. Moving Coil Speaker and Valves. Brand new. List £8 10s.

**57/6** LISSEN BAND PASS 3 BATTERY CHASSIS. With Valves, details as above.

**42/6** LISSEN BAND PASS 3 BATTERY CHASSIS. Less Valves.

**45/-** LISSEN 100 STATIONS SET. Complete in Cabinet with Valves and Speaker, Aerial tested, few only.

**75/-** 4 VALVE A.C. MAINS CHASSIS, 200 to 250 volts, by well known proprietary manufacturer, Mullard Valves, Band Pass tuned, suitable for use with energised Moving Coil Speaker, brand new.

**105/-** 4 VALVE A.C. SET. 200 to 250 volts, by well-known proprietary manufacturer, Mullard Valves, Moving Coil Speaker, Band Pass tuned, in handsome Walnut Cabinet, brand new, boxed. Hire purchase terms can be arranged on application.

**5/6** TRIAD VALVES. 01-A, 24A, 27, 30, 31, 32, 33, 35, 37, 38, 39, 41, 42, 43, 45, 46, 47, 53, 55, 56, 57, 58, 59, 71A, 75, 78, 80, 6A6, 1C6, 6F7, 2A3, 5Z3, 12A7, 6A7, 6C6, 6D6, 12Z3, 25Z5. ALL THESE VALVES CARRY A 90-DAY GUARANTEE AND FREE REPLACEMENTS, PROVIDED THAT THE FILAMENT OR HEATER IS INTACT AND THE GLASS IS NOT BROKEN WHEN RETURNED TO US. 5/6.

**2/6** LISSEN 2 VOLT BATTERY VALVES. 12 Metallised, brand new, boxed.

**3/6** LISSEN 2 VOLT CLASS B VALVES. Type BB 220 A. Brand new, boxed.

**2/11** POLAR 2 GANG CONDENSER. 0.0005 Section, unscreened.

**8/6** COMPLETE LISSEN SUPERHET ASSEMBLY. Comprising 3 Gang Superhet Condenser, 126 k/c Oscillator Section. Set of Ganged Superhet Coils with Switch and two 126 k/c. I.F. Transformers. A Wonderful Bargain.

**2/11** LISSEN INTERMEDIATE FREQUENCY TRANSFORMERS. 126 k/c. Brand new, boxed. List price, 8/6.

**2/11** LISSEN IRON CORED OSCILLATOR COILS. 126 k/c. Fully Screened. Brand new, boxed. List price, 12/6.

**8/11** BRYCE MAINS TRANSFORMERS. 250-0-250, 80 M.A. 2-0-2 Volts, 2.5 amps., 2-0-2 Volts, 4 amps. Shrouded.

**9/6** 350-0-350 volts, 120 m.a., 2-0-2 volts, 2.5 amps., 2-0-2 volts, 4 amps. Shrouded.

**11/6** 350-0-350 volts, 150 m.a., 2-0-2 volts, 2.5 amps., 2-0-2 volts, 4 amps., 2-0-2 volts, 2 amps. Shrouded.

**17/6** 500-0-500 volts, 150 m.a., 2-0-2 volts, 2.5 amps., 2-0-2 volts, 6 amps., 2-0-2 volts, 2 amps., 2-0-2 volts, 2 amps. Shrouded.

**8/11** H.T.S TRANSFORMERS. 250 volts, 60 m.a., 2-0-2 volts, 4 amps.

**17/6** DITTO. With H.T.S Metal Rectifier.

ALL THE ABOVE TRANSFORMERS ARE OF FIRST CLASS MANUFACTURE, BRAND NEW AND CARRY MAKERS GUARANTEE.

**5/-** UTILITY 3 GANG MIDGET SUPERHET CONDENSERS. With 110 k/c Oscillator Section, fully screened.

**2/11** BRITISH RADIOPHONE 3 GANG SUPERHET CONDENSERS. With 110 k/c Oscillator Section, unscreened. Wonderful bargain.

**2/6** 8 mfd. and 4 mfd. DRY ELECTROLYTIC CONDENSERS. By well-known manufacturer. 450 volt working, 500 volt Peak. Brand new.

**1/6** LISSEN CENTRE TAP OUTPUT CHOKES. Brand new, boxed. List price, 7/6.

**1/-** LISSEN INTERVALVE SMOOTHING CHOKES. Brand new, boxed. List price 7/6.

**2/6** PEAK 4 mfd. PAPER CONDENSERS. 750 volt test.

**1/-** PEAK 1 mfd. PAPER CONDENSERS. 500 volt working.

**1/-** 4 mfd. POST OFFICE TYPE MAINSBRIDGE CONDENSERS. 250 volt working.

**6d.** DRILLED METAL CHASSIS. 3 Valve type.

**6d.** 1 WATT RESISTANCES. All sizes, by well-known manufacturer.

**6d.** TUBULAR CONDENSERS. All sizes up to 0.1. By well-known manufacturer.

**HIVAC** VALVES. Complete range in stock, send for lists.

**2/-** G.E.C. 110 k/c INTERMEDIATE FREQUENCY COILS. Complete with two trimmers.

(Continued at top of column three)

# ★RADIO RECEIVER STANDS



Give your set a table to itself! Also suitable for extension speakers. These strongly-made stands have oak panel in front, and are supplied in white wood and specially surfaced for staining, polishing or painting at home to suit their surroundings. Tops are 15" x 10 1/2", and stands are available in three heights:— 17"-5/8, 18"-7/11, 24"-9/6; or in solid oak 8 3/4, 10/6 and 12/0. If desired polished (Top stainless and acid-proof) 2/9 extra. Cash with order, Carr. Paid. Eng. and Wales. Send to-day—Satisfaction or money refunded.

"HAMCO" WOOD Products, High Street, Hampton, Middx.

# CIVIL SERVICE VACANCIES

Age Limits 15-26; Either Sex. Excellent Commencing Pay. NO EXPERIENCE REQUIRED.

## WANTED

Numerous vacancies are now existing for keen applicants.



For details of these vacancies, and of Age Limits, Pay, Promotion and Entrance Requirements for all branches of the Service (Taxes, Customs, Post Office, Clerical, Engineering, L.C.C., Municipal, etc.), you are advised to apply for free copy of the 1936 Edition of Civil Service Handbook. FREE and post free on request.

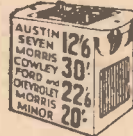
B.T.I. (Dept. 113), 356, Oxford Street. W.1.

# NEW TYRES GUARANTEED 15,000 MILES. ASSORTED MAKES.

By well-known makers, New Mantra's own wrappers. Sent on 7 days' approval against remittance or C.O.D. (except Ireland and Channel Isles). If required Carriage Paid send 1/6 per tyre extra. Quanta 2/6 per tyre extra or FITTED FREE at our depots.

New Silly Tyres Used	New Sitty Tyres Used
26x350 13/8	29x525 27/6
27x409 15/6	30x525 27/8
27x440 17/6	32x550 27/6
30x450 22/6	30x55 35/6
28x475 22/-	32xGT 47/6
30x475 22/6	32xGHD 55/-
29x500 21/6	36x6 55/-
30x500 22/6	34x7 55/-

Other Sizes pro rata. Tubes and cheaper tyres—prices on application. SEND FOR 92pp. PRICE LIST FREE. General Motor & Tyre Co., 51/91, Queen St., London, W.6. Riverside: 6388 (10 lines), 370, Gray's Inn Road. (Phone: Terminus 4420 (6 lines).)



# EASY TERMS

Everything Radio supplied on the lowest terms. Send list of requirements for quotation by return. Prompt delivery. Cash and C.O.D. Orders Despatched by Return.

## W.B. STENTORIAN UNITS

Cash Price £2/2/0, or 2/6 with order and 11 monthly payments of 4/-. 36.S

Cash Price £1/2/6, or 2/6 with order and 11 monthly payments of 3/-. 36.J

ROLA L.S. Units supplied on similar terms. ALL CARRIAGE PAID

Estd. 1925 THE PHONE NATIONAL 1977

# LONDON RADIO SUPPLY COMPANY

11, OAT LANE NOBLE STREET LONDON, E.C.2



(Continued from foot of column one)  
1/3 G.E.C. 500,000 ohms VOLUME CONTROLS. With Switch.  
1/11 G.E.C. MANUFACTURERS TYPE L.F. TRANSFORMERS.  
ALL ORDERS VALUE 10/- OR OVER, CARRIAGE PAID IN UNITED KINGDOM.  
ORDERS UNDER 10/- MUST BE ACCOMPANIED BY A REASONABLE AMOUNT OF POSTAGE.  
NO ORDERS UNDER 10/- WILL BE DEALT WITH UNLESS POSTAGE IS INCLUDED.

# RADIO CLEARANCE

63, HIGH HOLBORN, W.C.1. TEL.: HOLBORN 4631.

## RECEIVERS, COMPONENTS AND ACCESSORIES Surplus, Clearance or Secondhand, etc.

SOUTHERN RADIO'S Wireless Bargains; all goods guaranteed and sent post paid.

**SPEAKERS.** Celestion, Soundex permanent magnet, 11/-; Celestion, mains energised, 2,500 ohms (model E.6), 8/6; Telsen latest type permanent magnet, with ten ratio transformer for use with any receiver including Class B and Q.P.P., 14/6 each; Telsen loud speaker units, 2/9 each; all new and boxed.

**L** LISSEN 3-valve Skyscraper Kits, new, in sealed cartons with 3 specified valves, 42/- each (list 77/6).

**D** EEMARK Short-wave Adaptor Kit, complete with all accessories for adapting set to 14-150 metres, 20/-; superhet short-wave converter kit, 20/-.

**G** E.C. A.C. D.C. Mains 3-valve Sets, complete with 3 Osram valves in exquisite Bakelite cabinet, with Osram M.C. speaker, ready to plug in to any mains universal voltage, new, in sealed cartons, fully guaranteed; £3/10/6 (list £7/15).

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**ADVERTISEMENT INDEX**

	Page
B.T.I.	36
Belling & Lee, Ltd.	31
Bennett College, Ltd.	24
British Institute of Engineering Technology	
British Television Supplies, Ltd.	Inside Back Cover
Bulgin, A. F. & Co., Ltd.	29
Clarion Radio Valve Co.	Inside Back Cover
Corsor, A. C., Ltd.	9
Electradix Radios	36
General Motor & Tyre Co.	13
Graham Farish, Ltd.	36
"Hamco" Wood Products	Inside Front Cover
H.M.V.	28
International Correspondence Schools	36
King's Patent Agency, Ltd.	31
Lectro Linx, Ltd.	36
London Radio Supply Co.	35
New Times Sales Co.	21
Peto Scott Co., Ltd.	32
Fix	30
Stratton & Co., Ltd.	36
362 Radio Valve Co., Ltd.	23
Technical & Commercial College, Ltd.	
The Technological Institute of Great Britain	
Unit Radio	Inside Back Cover
Waverley Book Co., Ltd.	14
Westinghouse Brake & Signal Co., Ltd.	20
Whiteley Electrical Radio Co., Ltd.	25
W. D. & H. O. Wills.	26

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