Practical Wireless

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September 22nd, 1934.

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PRACTICAL WIRELESS
September 22nd, 1934

B

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ROUND the WORLD of WIRELESS

Greetings

Many thanks to the many readers who have sent messages of goodwill in connection with our second birthday—and the completion of Vol. IV.

"Newnes' Television and Short-Wave Handbook"

The latest addition to our series of presentation volumes, "Newnes' Television and Short-Wave Handbook," is available to all regular readers who comply with the simple conditions given on pages 24 and 25 of this week's issue. Reserve your copy at once.

Microphonicity

We observe in a contemporary a new word—microphonicity! Ugh! After this we may expect telephonicity, telegraphicity, metaphysicity, telescopicity, and microscopicity. Personally, we prefer the correct dictionary word—microphony!

Index to Vol. IV Now Ready

Those readers who are having copies of Vol. IV bound (Nos. 79-104, comprising issues dated March 24th, 1934, to September 15th, 1934) may have copies of the title page and index for 3.6d., or by post 4d. It is now ready. Binding cases, complete with title page and index cost 2s. 9d.

At the Blue Moon

"Once in a Blue Moon," described as "a romantic play with music," will be heard by London and Midland Regional listeners on September 25th. Francis Durbridge is the author of the "book," and music and lyrics are by Jack Hill. The scene is the Blue Moon Cafe, and the cast includes artists well-known to broadcasting: Gladys Joiner, Alma Vane, Worley Allen, Dorothy Summers, Hugh Morton and many others. Martyn C. Webster will be the producer.

The Harmony Boys

The Harmony Boys will be heard again on September 27th in a programme with the Govan Burgh Band, conducted by Gregor J. Grant, and Jackson Dodds (entertainer). The Harmony Boys—a combination which originated in one of the many ex-service men's clubs which sprang into existence in the years immediately after the War—first broadcast ten years ago, and in the interval have become widely known in Scotland.

From Sadler's Wells

The prologue and Act I of Rimsky-Korsakov's opera, "The Snow Maiden," will be relayed from Sadler's Wells Theatre in the National Programme on September 25th, which is the opening night of the season.

The scene of the prologue is the edge of the forest near the Red Mountain of Yarilo at the end of winter, and that of Act I is the village of the Berendeyas in spring. The cast includes John Greenwood, Betsey de la Porte, Roderick Lloyd, Olive Dyer, Powell Lloyd, Susan Turner, Edith Coates, Ruth Naylor, and Sumner Austin. The conductor will be Lawrence Collingwood. Clive Carey will be the producer, and the chorus master will be Geoffrey Corbett.

Bristol's Radio Exhibition

The Bristol and West of England Radio and Home Entertainments Exhibition, organized by the Bristol Evening World, will be held in the Colston Hall, Bristol, from September 24th to 29th. A relay of variety will be taken for West Regional provincial stations, when Tom Webster, the sporting cartoonist, will introduce the artists. Included in the programme will be Ronald Hill, Bertie Willmott, Tom Burke, and Freddie Williamson and his Dance Band. A concert will be relayed on Wednesday, September 28th.

S.O.S. Analysis

During the second quarter of 1934, 149 S.O.S. and police messages were broadcast Nationally and twenty-eight from provincial stations. In the case of those given Nationally, 107 were in respect of illness, seventy-one of which were successful, thirty-three unsuccessful, and three unknown. The percentages were 65.60, 30.84, and 2.8 respectively. Forty messages called for witnesses of accidents, twenty-three, or 57.5 per cent., of which were successful, and seventeen, or 42.5 per cent., unsuccessful. Two were special or crime messages, neither of which met with success.

Of twenty-eight broadcasts from provincial stations, twelve were in respect of illness, four, or 33.33 per cent., being successful, and eight, or 66.67 per cent., unsuccessful. For witnesses of accidents there were ten messages, half of which were successful. Six crime or special messages were broadcast, three being successful.

A Choral Event

On September 22nd, the Wisbech Male Voice Choir, three winners of "the open" at the Norwich Festival, and holders for two years of the South Midland Championship Cup, have their first Regional broadcast from the Midland station. They have sung at Broadcasting House for the National programme, and still recall a hectic afternoon in May, 1932, when they made two singing films in London, recorded and broadcast. Mr. F. Ingram, who founded the Choir eight years ago, is the conductor. There are over forty members, several of whom have to travel from March to Wisbech for rehearsals.
**ROUND the WORLD of WIRELESS (Continued)**

**PRACTICAL WIRELESS**

**America's Cup**

The first race in the series for the America's Cup took place on September 15th. To secure the trophy one of the competing yachts must win four races, and consequently the deciding race cannot take place before September 19th. It is more probable, however, that the issue will not be decided until perhaps September 22nd, or even a later date should postponements occur on account of bad weather.

On the evening on which the deciding race is completed a special programme entitled "Endeavour's Challenge for the America's Cup" will be broadcast on the National Wireless at approximately 11.15 p.m. This will be an expensive news presentation, and will include a brief history of the Cup and the competing yachts. It will also give incidents in Endeavour's short career. It is hoped to conclude this composite programme with a relay from America.

The programme will be devised and produced by Gerald A. Cock.

**Cornish Harvest Customs**

A. K. Hamilton Jenkin will give a talk for West Regional listeners on Friday, September 28th, on Cornish harvest customs. In this talk Mr. Hamilton Jenkin describes the ceremony associated with the cutting of the last few handfuls of standing corn in the harvest field, which is known as "crying the neck". It is only within the last thirty or forty years that the custom of crying the neck has ceased to be observed in the Duchy. A. K. Hamilton Jenkin is an acknowledged authority on the old customs of the Duchy, and has done much, not only in his talks, but also in his writings, to shed light on many ancient rites and ceremonies of which the truth was obscured or misunderstood. Of course, his reassuring must be accepted merely as opinions.

**Midland Auto Club**

In June, Whitney Straight made a new record on the Shelsley Walsh Hill Climb, recognized as the British event for the Hill Climbing Championship of Europe. He did the thousand-yard climb, which includes two sharp corners, in forty seconds. He did the thousand-yard climb, which includes two sharp corners, in forty seconds.

"Gaelic To-day"

On September 28th Sheriff McMaster Campbell will give a talk for the PICK-UP RESPONSE TESTER

Visitors to the Radio Exhibition were very interested in the H.M.V. tester shown above. The response curve is shown on the screen whilst the pick-up is working. Note the stroboscopic edge to the turntable.

**Solve THIS!**

**Solution to Problem No. 104.**

Martin had so chosen the value of coupling condenser that it had a resonant frequency low down in the audio range. If he had tried condensers of different value he would have found that reproduction was satisfactory.

The following three readers successfully solved Problem No. 103 and books have accordingly been awarded to them: Benjamin Norsworthy, 55, Winchelsea Street, Bethnal Green, E.2; F. W. Cooper, 11, Peel Street, Birmingham 15; J. N. Avery, 73, Harrow Street, Hutt.

**Scottish Regional**

Scottish Regional on "Gaelic To-day, and the Mod," preceding the relay from the concluding concert of the National Mod being held at Oban. This festival of Gaelic is of great importance to the Highlands of Scotland, and so great is the interest shown in it that folk gather from all parts of the British Isles and sometimes even from abroad. The relay is from the concluding concert, at which the prize winners will appear.

**Salonika Reunion**

The Salonika Reunion Association Service, conducted by the Rev. H. G. Marshall, Assistant Chaplain-General, Eastern Command, will be relayed to National programme listeners on September 30th, from the Horse Guards Parade Square.

The service will be opened by the singing of "O valiant heroes, who to your glory came," and following prayers the Rev. H. G. Marshall will give his address. Then "Good of our Fathers, known of old" will be sung, and the service will conclude with Benediction and the playing of the Last Post. By permission of Lieut.-Colonel R. E. K. Leatham, Assistant Chaplain-General, Eastern Command, will be relayed to National programme listeners on September 30th, from the Horse Guards Parade Square.

"Squaring the Circle" will be broadcast on September 26th in the Regional programme, and on September 28th in the National, as a farce dealing with the housing problem of the post-revolution period in Moscow. It carries no political significance whatever, and is written in an extremely amusing vein. The author is Valentine Kataev, and N. GooiDEM Verschoyle was responsible for the translation from Russian into English.

"Squaring the Circle" was staged at Ashley Duke's Mercury Theatre, where it was seen by the B.B.C. Director of Drama, Val Gielgud, who will produce the broadcast version. The adaptation for broadcasting is by Marianne Helweg. Only five artists will be required for the cast.

**Another New Cinema Organ**

A NEW cinema organ comes into the Midland Regional programme for the first time on September 24th, namely, that at the Ritzy, Nottingham. Scottish Regional has 290 "tabs," is one of the largest cinema organs in Europe. The player will be Jack Helyer, organist at the cinema.
VISUAL TUNING FOR THE CONSTRUCTOR

A Number of Suggestions for the Construction and Use of Simple Tuning Indicators are Given on This and the Following Page. By FRANK PRESTON.

VISUAL-TUNING indicators are to be found on nearly all modern commercial receivers of the more pretentious type, and there are probably many constructors who would like to fit such devices to their own sets. Before describing some methods of providing visual means of tuning it might be advisable to point out the particular advantages and difficulties which are attendant upon it. In the first place it should be emphasised that the full benefits of visual tuning can only be obtained in the case of a receiver provided with automatic volume control. With sets of this type it is practically impossible to make rapid tuning adjustments by ear, due to the fact that, as the set is slightly detuned from the resonant point of any particular transmission, the amplification of the H.F. stages becomes greater, with a consequent increase in the anode current which the meter passes is inversely proportional to the grid-bias voltage. In other words, the anode current becomes less as the G.B. voltage increases.

De-Tuning Produces Distortion

But, particularly when the set is very selective, slight de-tuning immediately produces distortion, due to the over-emphasis of one side-band and the partial suppression of the other. Thus, in tuning such a receiver by ear, one must not tune to the loudest point, but to the position at which there is no distortion—a difficult procedure. When a system of visual tuning is provided, however, all that is necessary is to select the approximate tuning position for the desired station, and then carefully set the tuning dial until the visual device (which may take one of many forms) indicates exact resonant content.

Contrary to popular opinion, a visual-tuning indicator is by no means a complicated device, and its method of operation is easy to follow. Additionally, it is generally a perfectly simple matter to construct a visual indicator from simple and comparatively inexpensive parts. To understand exactly how it works, one must bear in mind the function of all systems of A.V.C.: a minute portion of the signal voltage applied to the grid of the detector (the second detector of a superheterodyne) is rectified and passed back to the grids of the H.F. valves as negative bias. Consequently, as the detector receives a greater signal voltage, so the H.F. valves are more heavily biased. And it is a principle of the valve that the anode current which it passes is inversely proportional to the grid-bias voltage. Thus, in other words, the anode current becomes less as the G.B. voltage increases.

It will now be clearly understood that if a milliammeter is inserted in the anode circuit of one or more of the H.F. valves its reading will be at a minimum when a station is exactly tuned in. A meter of this kind, connected as shown in Fig. 1, is the simplest form of visual-tuning indicator and is used in several commercial receivers. The only slight objection is that the reading of the needle becomes lower as signal strength increases. This can readily be overcome, however, by the simple process of making a new scale which reads anti-clockwise. The scale need not be calibrated in milliamps, but should preferably be divided into about ten equal sections.

To avoid possible instability due to the resistance of the meter in the anode circuit it is generally necessary to connect a 2-mfd. fixed condenser in parallel with the meter as shown. It is by no means essential that the meter for visual tuning should be accurately calibrated, and it is therefore quite permissible to use a cheap instrument costing no more than ten shillings. The most important point is that the meter should have a full-scale deflection of no more than the maximum current consumption of the valve in whose anode circuit it is connected. For example, when used with a single battery-operated variable-mu H.F. pentode, a maximum reading of 5 milliamps will generally be most suitable; when the meter passes the combined anode currents of two mains-operated variable-mu valves a suitable full-scale reading would be 10 milliamps.

Although many readers may be aware of the fact, it is interesting to point out that there are on the market a few special meters made expressly for visual tuning. These are made with the "reversed" scale mentioned above, and are available in three main patterns: with normal arc-shaped scale, with straight horizontal scale, and with straight vertical scale. Those who already have a suitable milliammeter can easily modify it to be more in keeping with the receiver controls by extending the pointer by attaching to it a length of thin aluminium wire bent to a right-angle, as shown in Fig. 2. This can be made to read over a curved scale made by gluing a strip of paper or white celluloid over the edge of a wooden dire or an old condenser drum.

Shadow Tuning

Another form of visual indicator, which is somewhat more spectacular than the (Continued overleaf)
from his native Wales 35 years ago and listeners in a programme of part-songs and the most successful was ”Tickets, Please.”

Ronald Hill has arranged forty-five

simple meter, that is in which the length of a shadow, or of a strip of light, is made to vary according to the strength of the signal being received. Some of the devices used are rather complicated—and they are not sold to the home constructor—but there are several arrangements which the constructor can devise, simply by making use of a slightly modified meter. One of these is shown in Fig. 3, where it will be seen that a strip of thin black paper is attached to the upturned pointer of the window.

Ronald Hill has arranged forty-five from previous page)

THE Bristol Harmonic Male Voice Choir will be heard by West Regional listeners in a programme of part-songs and Negro Spirituals on October 1st. The conductor, Joseph Jenkins, went to Bristol from his native Wales 35 years ago and liked it so much that he made his home there; he has trained scores of singers and has also established a number of choirs. In recent years his work has extended to North Devon, where he trains choirs and singers.

TOPICAL PARAGRAPHS

liked it so much that he made his home there; he has trained scores of singers and has also established a number of choirs. In recent years his work has extended to North Devon, where he trains choirs and singers.

PRACTICAL WIRELESS

September 22nd, 1934

the reading of the meter will increase as the set is brought to resonance. A similar arrangement, which is also shown in Fig. 5, can be employed when the detector operates on the leaky-grid principle, but the meter must then have a full-scale deflection of about 5 milliamps. When A.C. valves are used, or 2 milliamps. for battery valves, and the deflection is considerably smaller, so that accurate tuning adjustments cannot be made quite so easily. Additionally, it should be noted that with leaky-grid detection the current becomes less as resonance is reached. With all the arrangements described, a certain magnification of the needle movement can be obtained by placing the meter farther from the screen, or by lengthening the pointer. In making the pointer longer, however, care should be taken that the extra length does not weight it down or otherwise restrict its movement. In addition, it will be found that the screen must be recessed into the cabinet so that it is shielded from outside light. Also the intensity of the indicator light will be insufficient to make the shadow or lightstrip clearly visible.

Air Race Commentary

A running commentary on the finish of the London-Cardiff Air Race, organized by the Cardiff Aeroplane Club for the Western Mail Trophy, will be given for West Regional listeners by Captain W. R. Bailey on October 6th. This will be the fourth annual race: the three previous races were started from Heston Airport and, this year, by kind permission of the De Havilland Aircraft Co., Ltd., the race is being started from Hatfield Aerodrome. All aircraft finishing the race will be handi
enced by Mr. W. Daney, who has an international reputation as handicapper for the principal air races in England. All machines entering for this race fly non-stop from Hatfield Aerodrome to Cardiff Airport, with a compulsory turning point at Beccles, near Chester.
THE NEW DROITWICH STATION

Interesting Facts about the New B.B.C. High-power Transmitter

The Droitwich station has been designed as a dual-programme transmitting station, and in time it will house the new Midland Regional transmitter. In this article we propose to deal only with the long-wave transmitter that came into general use on Thursday, September 6th. The main points of difference in the design of the Droitwich station, as compared with the four Regional stations are:

1. The power house generates alternating instead of direct current.
2. Series modulation has been employed for the transmitter.
3. The high-tension supply is normally obtained from mercury-arc steel-tank rectifiers and not from motor generators. (Actually at the time of the switch-over on Thursday, however, motor generators were used. These will normally function in the new Midland Regional transmitter.)
4. An important unit, which has been termed the "transducer," has been introduced between the output of the transmitter and the feeder lines to the aerial transformer house to overcome the difficulty in obtaining a good response at the high-audible frequencies on the long wavelength.
5. The masts are 700 feet in height, the highest previously used by the B.B.C. being 500 feet.

The aerial is fed from the aerial-transformer house, supply being led to the latter through the so-called "transducer" (which will be mentioned again later) from the transmitter.

The transmitter is made up as follows:

(A) One three-stage low-frequency power amplifier with four 15-kW water-cooled power transmitting valves. (The final stages of (A) and (B) are connected in series.)

(B) One two-stage high-frequency power amplifier with four 15-kW water-cooled power transmitting valves. (The final stages of (A) and (B) are connected in series.)

(C1) and (C2). The two halves of the final push-pull-modulated high-frequency stage, each with three water-cooled, new type transmitting valves, each capable of a maximum output of 50 kW., one valve in each circuit acting as spare.

(D) The tuning circuits for (C1) and (C2).

Governing the transmitter is the power-control table, which has all essential transmitter controls. The transmitter requires an H.T. supply of about 30 amps. at 20,000 volts. This is normally supplied by one of two mercury-arc rectifiers, the other being used as a stand-by. In place of either of these, however, two H.T. motor-generators, having a maximum voltage of 12,000 each, may be used, though their normal purpose will eventually be to feed the new Regional...
transmitter. The power house contains four 750 b.h.p. six-cylinder Diesel engines and the same number of 470 kW three-phase alternators, each complete set being directly coupled. Normal speed is 375 r.p.m. and the output 415 volts. The maximum capacity of the power house is 1,880 kW., but the normal load will be 1,000 kW. There is a battery room containing a 1,500 amp.-hour 220-volt battery, for lighting, etc., when no programme is being radiated. Fuel-oil storage is provided by two tanks, each having a capacity of 150 tons.

The "transducer," which is situated between the output of the transmitter and the feeder lines to the aerial-transformer house, contains high-frequency circuits, the main function of which is to reduce attenuation of the higher audio-frequency sidebands, thus enabling the long-wave transmitter to have a straight-line frequency response up to about 9,000 cycles per second.

The aerial circuits are situated centrally between the two masts, and, of course, at the foot of the vertical down-lead. Two complete sets of aerial-tuning circuits have been installed in the aerial-transformer house, containing a large number of de-tuning elements. This principle has been adopted by the B.B.C. for the first time in this station, owing to the possibility of damage to this part of the equipment by the lightning flash which may not be cleared by the lightning arrestors. Situated immediately outside the aerial-transformer house is a steel pylon, carrying the lightning arrestors, and the termination of the down-lead from the aerial.

The station is connected to the simultaneous broadcasting land-line network by means of buried cables to Birmingham. A special input control room contains, in addition to the line relay switching circuit, all the necessary line-amplifiers, programme meters, and "line-monitoring" circuits. The amplifiers are mains-driven, the H.T. supply coming from rectifiers and the L.T. supply from motor generators, through suitable smoothing circuits.

The Part Droitwich Will Play

The new transmitter was designed for a power of 150 kW. to its aerial, that is, at least three times the power of any station previously built by the B.B.C. It should give a satisfactory service under average atmospheric conditions to nearly the whole of the British Isles. It is anticipated that it will in time be possible to withdraw the National transmitters at Washford Cross, Moorside Edge, and Brookmans Park. It will not be possible to determine the exact performance of the station until it has been in regular service for at least a year and all types of atmospheric conditions have been encountered.

Where Inconvenience May Result

Users of unsel ective receivers in the immediate neighbourhood of Droitwich will undoubtedly have something to contend against in receiving other stations without interference, and to a lesser extent will users of unsel ective receivers elsewhere, owing to the greatly increased signal strength provided by the new transmitter. This applies whether the interference occurs when receiving foreign stations fairly near in frequency to the Droitwich transmission, or even when transmissions separated widely in frequency are being received, depending on the degree of selectivity. The carrier-wave frequency of Droitwich being 200 kilocycles per second, the band of frequencies occupied is from 191 to 200 kilocycles per second, and this spread will have to be reckoned with at present transmission power. The remedy, of course, is to make the receiver sufficiently selective to cope with the changed conditions. Those who live within a small heart-shaped area surrounding Daventry (the flattened part of the heart pointing towards Droitwich) will find transmission weaker than they have been accustomed to by virtue of their extreme proximity to the former transmission, but only those who have been taking advantage of an accident of birth, as it were, and making do with a receiver that is only practicable at very short range. A certain amount of grousing there may be, but it is worth remembering that what the B.B.C. have done is undoubtedly for the benefit of the majority of listeners.

WHAT IS YOUR FAVOURITE CIRCUIT?

Competition Result Next Week.

We have received many thousands of entries for the "What is Your Favourite Circuit?" Competition which appeared on page 618 of our issue dated August 18th (First Special Show Number). The work of deciding the favourite circuit as decided by the votes of the competitors has been extremely heavy, and it was impossible therefore to include the results as promised in our issue dated Sept. 15th.

The following, however, is an analysis of the voting; and readers will agree that this provides really valuable information for our designers and enables them to design receivers of popular demand.

Our Competition Editor is busily at work judging the competition, and the names and addresses of the winners of the Fifty W.B. Stentorian Loudspeakers will definitely appear next week.
Preparing for Winter Reception

Some Methods of Improving Selectivity, Particularly on the Long-wave Band, which will Soon Present a Difficulty

Due to the Opening of the Droitwich Station, are Described Below.

On first thought it might appear that the title of this article is scarcely justified, and that no special preparation for reception during the darker months is called for. But those who have built a receiver (particularly if it is of the simpler type) during the past few months will already have noticed that reception conditions are rapidly changing.

The first sign is that a considerably greater number of stations can now be received than was the case, say, a month ago. The chief reason is that the hours of daylight are shorter and reception conditions are always much better after dark. In many ways it is an advantage to have more stations available, but there is also the accompanying disadvantage that the problem of cutting out unwanted stations is more difficult of solution. It is therefore found that the set's selectivity must be increased.

"Practical Wireless" Selectivity Booklet

A number of methods of improving selectivity were described in the booklet which was given free with PRACTICAL WIRELESS dated January 20th, 1934, and it is not proposed to repeat the information given there. It might be mentioned, however, that back numbers of the copy referred to can be obtained for 4d, post paid from: The Publishing Department, Messrs. Geo. Newnes, Ltd., Exeter Street, London, W.C.2.

One of the simplest (and also the most effective) methods of increasing selectivity is by adding an H.F. amplifier to the existing receiver, and a design for such a unit was published in this journal for November 20th, 1933; for the convenience of new readers the circuit of this amplifier is reproduced in Fig. 1 on this page. Although it is nearly a year since this design was given, the unit is still eminently up to date, and the only recent improvement which it is suggested might be incorporated is a variable-mu H.F. pentode valve. A Coaxor VPT 210 is suitable, and this can be obtained with a four-pin base, so that it can simply be inserted in place of the plain variable-mu originally specified without any alteration to the wiring being called for.

An A.C. H.F. Amplifier

Owners of mains-operated receivers are rather at a disadvantage when it is desired to provide an additional valve stage because the power-supply unit is not always capable of supplying the extra current required. In most instances there is a little surplus H.T. current, but on the L.T. side the transformer is generally designed to give the current required by the valves in the set, and no more. In such instances the simplest method of overcoming the difficulty is by providing the extra amplifier with its own L.T. transformer, as is shown in Fig. 2, which is a circuit similar to that in Fig. 1, but modified for A.C. operation. The lay-out of the components might be practically the same as in the battery amplifier referred to above, whilst the method of connecting to the receiver is evident.

In the case of a set which is already provided with an H.F. stage, and when selectivity is almost sufficient, it will often be found that a suitable improvement can be secured by the simple process of replacing the ordinary S.G. or V.M. valve by a corresponding one of the H.F. pentode type. In many instances the set will not require to be modified in any way, although it will sometimes be desirable to change the resistance values slightly.

Reducing the volume, by increasing the grid bias on the valve, increases the effective impedance of the valve, and thereby minimises the damping effect.

On the Long Waves

Quite apart from all the points mentioned in the opening paragraph it must be borne in mind that the set's selectivity must be increased.
THE winter season will be run on the same dramas. The transmission has been received at tremendous strength, and it has been found that it occupies the whole of the long-wave band on many of the older-type sets which are in use, whilst it can still be heard at the " top " of the medium waveband. Long-wave circuits have been largely ignored in the past, because it has seldom been of very great importance, but it must be faced that it is by no means an easy matter to get really sharp tuning on the long waves when a det.-L.F. style of set is in use, the methods which are effective on the medium waves using a series-aerial condenser, providing a loosely-coupled aerial winding, and tapping down the coil—are seldom of much value. The most reliable method of all is to employ a band-pass filter, and this should preferably incorporate inductive coupling. This will generally make it necessary to buy a new pair of coils, as well as a new aerial condenser to cover the extra tuning circuit. At the same time it might be possible to make use of the coil at present fitted to the set in conjunction with another one. "Coupling" windings will have to be placed on both coils, and these may consist of a total of seventy turns of 32-gauge d.c.c. wire, of which twenty turns are wound in the same direction as those of the original coil, and the "coupling" windings should be cross-connected as shown in Fig. 3. To secure really satisfactory results by this method will probably involve a good deal of experimentation in order to find the optimum position and numbers of turns for the new windings.

Using a Wave-trap

Although it is a method which is not recommended too strongly, long-wave tuning can be much improved by the use of a simple wave-trap, which will prove valuable to those whose transceivers are within fifty miles of Droitwich. The wave-trap will consist simply of a coil and condenser wired in parallel, one end of the circuit being joined to the aerial terminal on the set, and the other to the aerial lead-in, as shown in Fig. 4. The coil may be a No. 150 plug-in type, or may consist of a winding of 130 turns of 32-gauge enamelled wire on a 24in. diameter cardboard former, whilst the condenser may be of the usual type or may be a pre-set one of .0003 mfd. maximum capacity.

The idea of this series wave-trap is that if it is tuned to the wavelength of the interfering station it will reject the signals from that station. The method of adjusting it is first to tune in the interfering station to its maximum strength, and then to vary the capacity of the pre-set condenser until the signals disappear or become very weak. Once that has been done the wave-trap need not be touched again unless the powerful transmission (Droitwich in the case under consideration) is required.

"The Stuff of Radio"

LANCE SIEVEKING, the B.B.C. playwright, has just done a new and highly original book, "The Stuff of Radio," Writing for the Microphone: Acting before the Microphone: Producing the Play, and eight complete plays by Sieveking, are but a few of the items in this remarkable book. There are a dozen photographs and drawings, some discussion of other books on the same subject, and comprehensive appendices with diagrams. For those who like speculation about the Future there are Prologues. Containing over 400 pages, it costs 8s. 6d.

Winter Season of Promenade Concerts

THE B.B.C. announces that a two-weeks' season of Promenade Concerts will be given at Queen's Hall from December 31 to January 12, inclusive. The winter season will run on the same lines as the famous summer concerts, and the services of Sir Henry Wood have been secured.

"Jannock" Postponed

UNFORESEEN circumstances have necessitated the postponement of D. G. Bridson's feature, "Jannock," from September 18th to November 12th; in its place on the earlier date "Muggleston on the Map: a Municipal Mockery," by A. V. Williams and Ernest Milligan, will be broadcast. This short play tells the tale of a small Lancashire township in which nothing ever seemed to happen, until His Worship the Mayor (also a local brewer) decided to institute a police raid on a rival public house. Then things woke up with a vengeance.

A Train Secretary

LORNA C. PHELPS, train secretary on the London and North Eastern expresses between Newcastle and London, comes to the microphone on September 28th to tell West Regional listeners about her work. She was born in Cardiff, but began her business career in London at the age of sixteen. She has typed letters on the train for Cabinet Ministers, business men, and lovers; she deals with the correspondence of foreign visitors, and does not get confused by the strange dialects from the remote parts of the British Isles which come her way.
4,000,000 Wireless Sets Out Of Date
AFTER SEPT. 6
Here are three important news announcements about radio...
Four million wireless sets in British homes will become out of date with the opening of the B.B.C.'s new high-power station at Droitwich on September 6. The new conditions call for super-selectivity, otherwise you simply cannot get the Stations you want without interference.
If the selectivity of your set could be better—if your favourite station is swamped out—don't worry—SLOT makes reception keener, clearer, it conquers interference; it brings in more stations. No need to buy a new Set for the new conditions—try SLOT on your present Receiver, it takes but a moment to fit.
This [wonderful new "Atlas"] T.10-30 is quite unique. It has no less than 6 TAPPED OUTPUTS. This ensures correct H.T. supply to any and every battery set—straight, superhet, Class "B" and "Q.P.P." Not only is it the ideal mains unit for your present set, but it is also the ideal unit for every set you may buy or construct in the future.

In addition to H.T. supply it embodies a trickle-charger to keep your accumulator always fully charged.

FOR A.C. MAINS

H.T. Tappings 60-30 v. (min. and max.), 50-90 v. (min., med. and max.), 120 v. and 150 v. Tapping Outputs 10, 20, or 30 m/A at 120 or 150 v. Trickle Charger 2 v. at 0.5 amps. Westinghouse Rectifiers. Guaranteed 12 months.

H.P. Terms: 10/- deposit and 8 monthly payments of 8/- each.

Ask your dealer to-day for a demonstration.

OTHER MODELS FROM 39/- CASH OR 10/- DEPOSIT.

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**POLAR MAINS UNITS**


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**HORIZONTAL DRIVE**

shown on the condenser above is slow motion with vertical moving pointer and is provided with two Lamp-holders.

**POLAR ARCULATE DRIVE**

(for use in the ALL-PENTODE THREE)

A slow motion drive with bevelled scale and moulded escutcheon. Complete with Lamp-holder ... ... 5/-

The two drives illustrated and the new Polar Vertical C.K. drive (Price 6/-) are all interchangeable for use with the "Midget," "Minor" and other Polar Condensers.

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Phone: Temple Bar 2244. Works: OLD SWAN, LIVERPOOL
RUNNING YOUR SET FROM THE MAINS

Several Methods of Operating a Battery Receiver from A.C. and D.C. Mains Supplies are Described and Illustrated in This Article.

The proportion of mains-operated to battery-operated receivers now in use is steadily increasing. There are several reasons for this, one rather obvious reason being that the electrical grid scheme is taking electricity into hundreds of new homes every week. Another reason is that it is now almost as cheap to build (or even to buy) a mains set as one intended for battery operation; and it is well known that the cost of operating a mains receiver is infinitesimal by comparison with that of running a similar type of mains instrument. Added to these advantages, there is the almost complete and unfailing reliability of the mains set as compared with the constant risk of rundown batteries—always when a programme is most required.

When we turn to home construction we find that the number of mains-operated sets, compared with the number of battery receivers, is not nearly so high as the corresponding ratio where ready-made sets are concerned. This is no doubt partly due to the fact that many constructors feel something afraid of building mains apparatus, feeling that there is a certain amount of risk attached to such an undertaking. It is certainly wise to treat a 230-volt mains supply with all due respect but, provided that reasonable precautions are taken, there is nothing to fear, and nothing very difficult to do.

The Simplest System

There are a variety of different methods of converting an existing battery set for mains operation, the most suitable being largely dependent upon the kind of supply, the type of receiver, and the amount which one is prepared to spend. The simplest method of obtaining all mains working is to employ an H.T. battery eliminator of the type provided with a trickle charger for keeping the accumulator "up." This system can be adopted without making any alteration to the receiver itself, and the general arrangement is shown in Fig. 1. It will be seen that a change-over switch is used to switch on and off the eliminator, trickle charger, and accumulator, the idea being that when the switch is "off" the accumulator is connected directly to the H.T. terminals of the receiver, the trickle charger is out of use, and the H.T. supply from the eliminator is applied to the set. When the switch is turned to the "on" position the accumulator is disconnected from the set and joined to the output terminals of the trickle charger, the H.T. supply being cut off.

Not Economical on D.C.

Details of the eliminator and charger are not given in the drawing, but these may be of standard type and can easily be made according to instructions which have previously been given in these pages, or they can be bought ready made from all makers of mains apparatus. It is also possible to buy complete eliminators which are complete with trickle charger and the change-over switch referred to.

The method just dealt with is applicable to both A.C. and D.C. supplies, although it is by no means economical when direct current is used because the mains voltage must be "dropped," by means of a resistance, to that of the accumulator while the latter is being charged. This means that, if the accumulator has a voltage of 2 and is to be charged at .5 ampere it will consume 1 watt (volts times amps). But to obtain this amount of power the drain on the mains supply is 6 amp. at, say, 220 volts, or 110 watts. Thus, for every watt used 109 are wasted. In terms of expense it means that the approximate cost of charging a 2-volt, 30-a.h. accumulator will be 1s. 1d.
when current costs 2d. per unit. There are other methods of operating a set from D.C. but these entail certain modifications of the set itself, and will be considered later.

**Using Mains Valves**

Reverting for the time being to A.C., it should be mentioned that the full benefit of mains working is not obtained by retaining the battery valves and using an accumulator and eliminator. Modern indirectly-heated A.C. valves are considerably more efficient and afford considerably better reception, the only objections to their use being the additional expense and the fact that the circuit must be modified to a certain extent. The modification is of a simple enough nature in the case of a standard type of three-valve receiver, but the reader is not advised to attempt it with a more pretentious type of circuit. In the latter case it is better entirely to rebuild the set, for otherwise it is almost certain that several difficulties will present themselves, the chief one being that of instability.

When the receiver is of the popular S.G., det., pen. variety the principal modifications concern the L.T. circuit, due to the fact that A.C. valves do not have a filament, but a heater and a cathode take its place. The arrangement of the mains unit, as well as the wiring of the heater and cathode circuits, is shown in Fig. 2. The mains transformer has two secondary windings, one of which supplies the L.T. current for the valves (4 volt, 4 amp.); the other giving the voltage necessary for feeding the metal rectifier, which is connected on the "voltage doubler" principal. The only function of the voltage necessary for feeding the metal rectifier, which is connected on the "voltage doubler" principal. The only function of the voltage necessary for feeding the metal rectifier, which is connected on the "voltage doubler" principal.

The method of converting a battery set into one of the universal mains type is very similar to that of modifying into A.C. operation, and the circuit given in Fig. 3 will make the idea quite plain. The circuit actually shown is for an ultra-simple type of three-valve universal receiver, but it serves to demonstrate the chief features. A practical wiring plan is not given, but it will be understood that the general arrangement is almost the same as in the case of A.C. working.

**Modifying a D.C. Set**

It is worth mentioning in this article that those readers who at present have a D.C. set can modify it for universal A.C. or D.C. working fairly simply by adopting an arrangement something like that illustrated in Fig. 4. In this case ordinary indirectly-heated D.C. valves are used, the heaters being connected in series with one another and with a "ballast" resistance and a 25-ohm variable resistance, by means of which the exact voltage required by the heaters can be obtained. In this circuit a metal rectifier is employed, and this feeds directly into the H.T. circuit through the customary 30-henry smoothing choke. Electrolytic condensers are used for smoothing, and these are generally most effective in any mains receiver, the only objection being that care must be taken in inserting the power plug into a D.C. supply socket to ensure that correct polarity is obtained, otherwise there is a danger of some type of condenser being damaged.
The extraordinary performance of these new moving-coil speakers is now universally acknowledged. "You have surpassed yourselves," says Mr. F. J. Camm, editor of "Practical Wireless," and in enthusiastic reports other leading technicians have expressed their delight at the results obtained.

Every leading wireless journal has announced its wholehearted approval of the new design, and specified a W.B. "Stentorian", as exclusive or first choice for every important "constructor" receiver published.

The illustration shows some of the unique features which bring this revolutionary performance:

- Improved "Microloade" feature giving accurate matching.
- Oversize cone.
- New Whiteley Speech Coil exclusive to W.B. "Stentorians."
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Test a W.B. "Stentorian" on your set. Listen to the greatly increased volume, clearer definition, and new, vivid "realism." You will be amazed at the improvement it brings for such a modest outlay.

STENTORIAN

PERMANENT MAGNET MOVING-COIL SPEAKERS


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**FULL O' POWER BATTERY**

The Incomparable Radio Battery with exclusive features, which can be depended upon to provide the maximum of enjoyment from your wireless set, and the best possible service at the lowest cost consistent with dependability. Buy one to-day, it proves its value by performance.

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BE SURE AND ASK YOUR DEALER FOR A SIEMENS FULL-O-POWER BATTERY

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**Every set a SHORT WAVE set with the BRITISH GENERAL ALL WAVE TUNER**

This famous coil, covering all wave lengths from 14.5 to 2,000 metres, still remains the most successful of all all-wave tuners.

Its remarkable popularity is due to the superb workmanship, reasonable price and, above all, its unequaled efficiency.

Easy fixing and simple tuning.

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**NO-MAST THE WORLD'S BEST AERIAL**

Nester and far more efficient than the old-fashioned ugly pole aerial. Enables you to tune in stations never heard before on your set, increasing volume and reducing interference. Is non-directional, designed for modern congested wave-lengths. Especially valuable to flat-dwellers.

10/6 Complete with all fittings

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Stocked by over 1500 Appointed Dealers

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ASKED AND ANSWERED
AT
RADIOYMPIA

This Article Gives a Brief Résumé of the Various Inquiries Dealt with by Our Technical Staff at the 1934 Radio Exhibition

I. THE PRACTICAL WIRELESS Advice Bureau endeavours to give readers free advice of a reliable nature, but it is sometimes found very difficult to ascertain the nature of a receiver fault from information given in a letter. We therefore welcomed the arrival of Radiolymia, as by personal contact with our readers we were better able to solve their problems. This is possible by means of a postal reply.

During the recent exhibition, thousands of readers visited our stand in order to avail themselves of our free advice service, and many intricate problems were solved by the technical staff in attendance. Often we were asked to submit suggestions, and we would assure them these are being given careful consideration.

PRACTICAL WIRELESS Receivers

We were not able to exhibit all the sets we have designed during the past twelve months, but the most popular ones were available for inspection. The receiver that created a great deal of interest, especially with the ladies, was the Atom Lightweight Portable—our midget three-valve, well-thrown-out aerial. We are now convinced that there is a greater demand for a compact set of this type than for the frame-aerial type of portable, and, therefore, we are now concentrating on the design of economical receivers for short-wave reception. During the coming season it will be possible to run a three- or four-valve superhet that will compare in sensitivity with a straight receiver than a superhet, this being mainly due to the high degree of selectivity obtained with the latter type of receiver, with the consequent necessity for greater care being taken in adjusting the trimmer condensers.

Past season superhets have also proved more expensive to run than straight receivers owing to the use of more valves. Manufacturers have concentrated on the design of economical multi-electrode valves for use in superhets during the past few months, however, and, therefore, it is to be hoped that during the coming season it will be possible to design a three- or four-valve superhet that will compare in sensitivity with a straight receiver having the same number of valves—this, by the way, can hardly be said of last season’s superivs.

Servicing Difficulties

Judging from the number of inquiries received concerning receiver servicing, there is seemingly a great demand for up-to-date data on this subject. Fault tracing has been dealt with in a series of articles in PRACTICAL WIRELESS, but in the interests of new readers, this subject will be fully dealt with in a further series during the coming season.

It is evident, however, that many servicing difficulties which beset the average constructor could be cleared very easily if a knowledge of Ohm’s Law and the theory of the ammeter were acquired.

Most receiver faults can be located by means of an ammeter fitted with external series and shunt resistances for measuring voltage and resistance values.

Short-wave Troubles

The number of inquiries made relative to short-wave reception tends to indicate that there is a growing interest being taken in this branch of wireless. The main difficulties experienced by constructors are concerned with the methods adopted for converting existing broadcast band receivers for short-wave reception. Briefly, an adaptor is required if the receiver has no H.F. amplifying stage, the adaptor plug being inserted in the detector valve-holder. When the broadcast receiver is fitted with one or more H.F. stages, however, a converter should be used. It is only necessary to connect the output lead of this to the aerial terminal of the receiver, and set the receiver tuning dial at long-wave maximum; the converter-receiver combination will then function as a short-wave superhet.

Postal Inquiries

In conclusion, we would assure readers that we are anxious to help them in their difficulties, and every query is carefully dealt with, but we would point out that all available details pertaining to their problem should be given, and if this relates to apparatus described in PRACTICAL WIRELESS, delay will be avoided by stating the issue and page number on which the article appeared. Long, rambling letters containing vague requests take up so large a portion of the staff’s time that legitimate queries are sometimes delayed in consequence. We would, therefore, ask constructors to co-operate with us in this matter, by ascertaining that their query comes within the scope of the Advice Service, as outlined on the Inquiries page, and by giving full details of their difficulty as mentioned above.

REMEMBER OUR QUERY SERVICE IS FREE TO ALL READERS
Some Effective Schemes which are Employed for Car Radio Receivers

The Vibrator System

There are two main types of vibrator, one having a valve rectifier and the other mechanical rectification. These two systems will be explained after the theory and design of the vibrator have been considered. Fig. 1 shows an interrupter circuit exactly as found in the electric bell or buzzer. In a position of rest, the steel spring A makes contact with B, so that the circuit is completed when the bell-push or switch is closed. The current then flowing through the coil L magnetizes the iron core and attracts the end of the spring away from the contact B, so that the current stops. The iron core loses its magnetization and returns to contact B. As it completes the circuit by this action, the entire cycle of movement is continued repeatedly so long as the switch is kept closed. The speed of the make and break will depend upon the strength and inertia of the spring, the amount of its travel and the power of the magnetic force.

Just at the moment of the break of the circuit the self-induction of the coil causes a high voltage to be produced, which, if not usefully employed, will discharge across the contacts and seriously pit them.

The Valve Rectifier Vibrator

The circuit in Fig. 1 has been developed into the more elaborate form of the valve-rectifier vibrator illustrated in Fig. 2. The interrupter circuit will be recognized at the coil L, with its iron core, and the spring A with the contact screw at B. The spring stops midway between the two contacts B and C in its position of rest. A special iron-ored transformer, centre-tapped on the primary winding, is connected at its outer ends to these two contacts. The secondary of the transformer can be regarded as an ordinary H.T. secondary winding connecting to the anodes of a rectifier valve in the usual way. A condenser is wired across the transformer primary to flatten out the high-potential peaks which, as previously mentioned, are created at the collapse of the magnetic circuit and to prevent excessive sparking at the contacts. The second condenser assists in this, and with the choke in the L.T. lead suppresses any H.F. interference.

When the switch is closed, the circuit is completed through the coil L, and half the transformer core becomes magnetized and pulls the spring A to make contact with B. Now the coil L is short-circuited and its hold over the spring is lost. The latter flies back to C so that current flows in the second half of the transformer. With the coil no longer shorted the spring is pulled again to contact B to start the cycle once more. Thus each half of the transformer winding becomes energized in turn, and the A.C. output is rectified on the secondary side in the usual way. A rectifier of this type has an efficiency of 40 to 60 per cent. and can deal with 50 milliamperes at 500 volts. The frequency of the A.C. output is about 200 cycles per second.

The Mechanical Rectifier Vibrator

The circuit of the mechanical rectifier vibrator is given in Fig. 3. It differs from the valve rectifier type only in the method of rectification. The secondary winding of the transformer connects to a set of contacts mechanically coupled to the interrupter B, C, and D. The efficiency of this system is not quite so high as the valve rectifier and, with the additional contacts, is not as reliable. Troubles with vibrators of either type described are nearly always connected with wear, pitting, or mal-adjustment of the contacts.

A HANDY service manual has just been issued by the Automatic Coil Winder & Electrical Equipment Co., Ltd., makers of the well-known Avo-meter, Avo-minor, Avo-daptor, etc. This book contains some valuable information regarding the testing of wireless receivers and wireless components and will prove invaluable to the service engineer as well as to the keen experimenter. Among the contents are: Standard Valve Tests, Standard Resistance Tests, Standard Condenser Tests, Inductance and Capacity Tests, Graphs for Determining Values of Inductances, Routine Tests for Receivers, Gauging a Straight H.F. Receiver, Superhetodyne H.F. and L.F. Circuits, Ganging Vibrators, Automatic Volume Control, and Gramophone Pick-up Arrangements. In addition the book contains numerous diagrams and graphs held in an album containing charts, tables, and ohms. The price of the book is 2s. 6d. (2s. 9d. post free) from the above-mentioned company. The address is Winder House, Douglas Street, London, S.W.1.
Universal-angle Soldering Iron

Many wireless constructors will find this adjustable soldering iron very useful when wiring sets. It is made from two 16-gauge cycle spokes. Rivets are made from brass springs. The iron can be screwed or soldered with silver solder. By pressing loop A the iron can be put to any angle between 100 and 30 degrees.

H. FEWLES (Glasgow).

A Clothes-peg "Synchronizer"

A simple device which acts very well as a television synchronizer can be made from a spring-type clothes peg.

Two holes, one about 1/2 in. diam., the other about 3/16 in., are drilled, one in each tapering end of the peg. A length of a spring-type clothes peg.

A Clothes-peg "Synchronizer"

A simple device for controlling the speed of a television-receiver disc.

By F. J. Camm (Editor of "Practical Wireless")

A BICYCLE-BELL clip, on the grubscrew of which a small cut-down paint brush has been mounted, will be found useful for obtaining better reproduction from gramophone records, if fitted to the carrier-arm of a pick-up.

The brush cleans the dust from the grooves before the needle traverses them.

D. BURTTON (Liverpool).

Galvo. from Old Brass Watch Case

The description of the construction of a pocket galvo. from an old brass watch case will serve as a guide for making one from almost any size of case.

Remove one of the brass plates. In the centre of drill a small hole to suit an end stone, such as jewellers use in watches. Cut a piece of brass to suit across the diameter of the plate. This strip should be 1/2 in. wide and 3/16 in. thick. Drill a hole at each end to correspond with holes in the plate. Mount this strip by means of two small pins. Centre a 1/32 in. hole in it and fit a shaft in it from the centre to form a pointer.

A graduated scale is shown below in the main sketch. Lap it with silk tape. Varnish and lap it once more with about 8 ft. of 28 S.W.G. silk-covered wire.

Take a piece of spring steel 1/16 in. in diameter by 1/2 in. long, magnetize it and fasten in cross section to the horseshoe magnet after taping and varnishing. Fasten the two magnets to the back of the brass plate by means of a short piece of chintz and small screws at the ends. Drill two holes at each side of the case for the placing of two terminals, and connect as shown in sketch.

A graduated scale should be fixed to suit.

W. H. GRAYLING (Cambridge).

Keeping Records Clean

This handy device keeps dust out of the grooves of the gramophone record.

50 Tested Wireless Circuits

By F. J. Camm (Editor of "Practical Wireless")

This handbook contains every modern circuit complete with instructions for assembling, components, values and notes on operation.

Costs 1/6 per copy, 6s. per dozen

George Newnes, Ltd., 84-86 W. C. 2.
CONSTRUCTIONAL DETAILS OF

Ultra Selectivity—Simple Construction—Powerful Output—Tone Control—Fretless Cabinet—

HERE are constructional details of my latest receiver. I want no fanfare of trumpets to proclaim the many important features which it incorporates. I prefer the receiver literally to speak for itself. The design carries with it my assurance that this it is well able to do in a convincing manner. It has always been part of my policy to originate—to start fashions, rather than to follow them. I think it is generally agreed that I have brought some degree of originality to home construction in the two years encompassed by the weekly issues of PRACTICAL WIRELESS. The "Fury Four," the "Featherweight Portable Class B Four," the "Atom Lightweight Portable," the "Leader" series of cheap receivers, and the "Summit," are but a few of the designs which have left the beaten track and definitely revived interest in home-constructed receivers.

Until the publication of PRACTICAL WIRELESS, the flat baseboard and panel system of construction had held sway from the very inception of wireless as a hobby. This journal was responsible for standardizing the wooden chassis system, and later the metallized chassis. This journal is the only one which guarantees its receivers when constructed from the parts we specify (no alternatives!), to function in the manner claimed. It is the only journal which makes no charge for its Query Service. That our policy has been soundly designed and was long overdue is supported by the goodwill we have built up in the brief space of two years; in spite of the fact that our policy is unfettered by advertising interests, we enjoy the goodwill and the co-operation of many thousands of readers and the entire radio industry.

A Real Advance

The "All-Pentode Three" marks another step forward in our policy of originality. It is not just another set. The only reason for inviting readers of this journal to make another receiver is that it should mark an advance on previous designs. My designs have been so popular in the past that they are still being made, notwithstanding the fact that my later designs represent a marked advance. The "All-Pentode Three" is my best receiver, it would not be presented to you if it were not. If you are interested in a receiver which gives equal selectivity on both wave-bands without loss of signal strength, which has a really healthy output, which employs iron-core coils, which has graded and extremely smooth volume control, which contains no stunt knob introduced merely as a stunt, employs tone correction on the output...
THE ALL-PENTODE THREE

Speaker Attached to Lid—Few Controls—Combined Wavechange and Radiogram Switch

valve, in fact, if you are interested in a receiver which represents the very latest for home constructors, the "All-Pentode Three" merits construction. Even the cabinet marks an advance; it is fretless. The speaker is attached underneath the lid and the sound escapes through the slots provided by a raised portion. I have long been of opinion that the fretted grille will be relegated to the limbo where repose the fretted-front pianos of the Victorian days. It is quite unnecessary, and whilst designers of radio receivers (like the designers of motor-cars who seem to think that the shape of the radiator is the only part of the car which can be improved) have concentrated their attention on producing some new design of grille, none of them, except myself, has thought it desirable to get rid of it altogether. You will like the arrangement. Not only does it permit a symmetrical arrangement of the cabinet; it also makes use of a waste piece of space between the valves and the lid. Microphony is markedly absent, and merely by raising the lid the internals are revealed for adjustment if and when necessary.

Simple Construction

You will find that the construction of the receiver is simplicity itself; the chassis can be obtained ready built up and only requiring to have a few holes bored in it. Also, as it is made of wood (the surface being metalized, of course), all the components can be mounted merely by the use of ordinary wood screws. In fact, so simple is the construction that to many readers a complete description of the process to be followed will be unnecessary. As, however, the set is sure to be made up by hundreds of readers who have not previously made a receiver for themselves, the following constructional details are given.

Positioning the Components

Having obtained the components, the first thing is to place the components in their approximate positions, which are clearly shown on the full-size free blueprint given with this issue, and also in the various photographs. Lightly mark in pencil the positions and then take the components away in readiness for drilling holes for the valve-holders and terminal-socket strips. The holes for the valve-holders are all 1 in. in diameter and can therefore easily be made by means of a brace and centre bit. It is hardly necessary to mention that each hole should be started from the top surface of the chassis baseboard, the circle traced on the under side, and the hole then completed from the top; this avoids any possibility of the wood being split or the holes being made jagged. The holes required for the terminal-socket strips are 3 in. in diameter and 3 in. between their centres. Two pairs of these holes are required, one for the aerial-earth strip, at the back of the chassis, and the other for the speaker connector on the left-hand side.

After attaching the valve-holders, it will be found most convenient to turn the chassis upside down and then to mount the few components on the underside; this will prevent any possible damage to such components as the tuning condenser and coil assembly. Next, attention should be paid to the variable condenser, which is attached to the chassis by means of three 3 in. screws which are supplied with it. The positions for the screw holes in the chassis are easily determined by using the template which the makers thoughtfully provide. The holes should be made 
\[ \frac{5}{32} \] in. in diameter by means of a twist drill, when the screws can be inserted from below. Care must be taken in mounting the condenser to ensure that the spindle of the "Arcuate" drive will project sufficiently far through the front of the cabinet.

The arrangement of the sub-chassis components of the "All-Pentode Three," and (right) a side view. Note the speaker lead strip.
MANY NOVEL FEATURES 
MOST IMPORTANT RECEIVER 
FOR HOME CONSTRUCTORS. 
WILL BECOME 

for the knob to be securely attached. This will be obtained by so placing the condenser that the extreme end of its operating spindle comes to within 1/8 in. from the front edge of the chassis.

Coil and Condenser Assemblies

Little need be said concerning the mounting of the coil assembly, since this is held in place by means of two 1/8 in. screws, the front of the metal chassis being approximately 1/8 in. from the front edge of the chassis. It will be noticed that two component brackets are used to support the reaction condenser and the variable-mu volume control. Both of these are screwed to the underside of the chassis and, in the case of the volume control, the screw should not be more than 1/8 in. long, otherwise they will touch the metal coating on the upper
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surface and might thereby short-circuit the potentiometer.

Easy To Wire

The wiring is just as simple as the assembly of the components, and can be undertaken with complete confidence. First of all, it will be found most convenient to connect up the coil assembly, and this matter is very much simplified by the provision of colour-coded leads which are attached to this assembly. Start by connecting the three yellow leads (from terminals 1) on the right-hand side of the unit to the three soldering contacts on the left-hand side of the gang condenser. After that the other coil connections can be dealt with in any order. It will be apparent from the blueprint that some leads go through holes in the chassis to components mounted on the underside, and the necessary holes can be made as the construction proceeds, by means of a .5132-in. drill. 4 holes can be made as the construction proceeds, by means of a wood screw with a washer placed under its head. The actual pick-up terminals have not been fitted, but a pick-up can be connected very easily by joining one lead to the front (vacant) terminal on the radiogram switch and attaching a wander plug to the other and placing this in the 1 volt tapping on the G.B. battery. If desired, it will be a perfectly simple matter to fit permanent pick-up terminals on the chassis, and these could be in the form of a terminal-socket strip similar to, and symmetrical with, the aerial-earth strip on the rear of the chassis. If this is done it is desirable in the interests of stability and with the idea of avoiding possible high-pitched whistles, to screen the lead from the terminal strip to the appropriate terminal on the radiogram switch. No matter which way the pick-up is connected it will be brought into circuit by the simple process of turning the wave-change knob to its third, or "gram" position.

Using a Pick-up

There is a radiogram switch (the black bakelite box) on the front of the coil assembly, and this is provided with three terminals. In the original set illustrated actual pick-up terminals have not been fitted, but a pick-up can be connected very easily by joining one lead to the front (vacant) terminal on the radiogram switch and attaching a wander plug to the other and placing this in the 1 volt tapping on the G.B. battery. If desired, it will be a perfectly simple matter to fit permanent pick-up terminals on the chassis, and these could be in the form of a terminal-socket strip similar to, and symmetrical with, the aerial-earth strip on the rear of the chassis. If this is done it is desirable in the interests of stability and with the idea of avoiding possible high-pitched whistles, to screen the lead from the terminal strip to the appropriate terminal on the radiogram switch. No matter which way the pick-up is connected it will be brought into circuit by the simple process of turning the wave-change knob to its third, or "gram" position.

The "All-Pentode Three" makes an excellent gramophone amplifier and can well form the nucleus of a complete radio-gram.

Full-Size Blue-print Wiring Diagram

LIST OF PARTS FOR THE ALL-PENTODE THREE

One Ferranti ganged coil assembly, type G1, 2 and 3 (Graham Farish).
One Baby 3-gang condenser (Jackson Bros.).
One Accurate drive (Jackson Bros.).
One 50015 mfd. reaction condenser, C7 (Graham Farish).
One 2000 mfd. fixed condenser, type M, C8 (Telsen).
One 2002 mfd. fixed condenser, type M, C9 (T.C.C.).
One 200 mfd. fixed condenser, type M, C6 (T.C.C.).
Two 200 mfd. fixed condenser, type M, C6 and C7 (T.C.C.).
One 2 mfd. fixed condenser, type 65, C10 (T.C.C.).
One 2 mfd. fixed condenser, type 65, C11 (T.C.C.).
Two .1 mfd. tubular condensers, C5 and C9 (T.M.C.).
One 25 ohm ohmite resistor, R1 (Graham Farish).
One 10,000 ohm ohmite resistor, R2 (Graham Farish).
One 50,000 ohm ohmite resistor, R3 (Graham Farish).
One 150,000 ohm ohmite resistor, R4 (Graham Farish).
Two 40,000 ohm ohmite resistors, R1 and R5 (Graham Farish).
One 50,000 ohm volume control, R1 (Ferranti).
One screened bi-polar choke (Telcon).
One screened bi-polar choke (Telcon).
One Max. transformer (Graham Farish).
Two 4-pin valveholders (Clix).
One 8-pin valveholder (Clix).
Two component brackets (2pin., (B.E.G.).
Two assorted strips (A, B, C and D) (Belling Lee).
One G.B. battery clip (Bulgin).
One 5-way batterycord with Wanderfuses (Belling Lee).
Three 1000 watt wander plugs, G.B., G.B., G.B.-1 (Belling Lee).
One Meterplex chassis, 22in. by 12in., 8in. runners (Pete-Scott).
One Cosser 210 VIT valve.
One Cosser 210 VFT valve.
One Cosser 220 HPT valve.
One Steintorfer standard speaker (PMS2) (W.B.).
One "All-Pentode Three" cabinet (Pete-Scott).
Wire for connections, screws, etc.
One 120-volt Bulb O’Power H.T. battery (Siemens).
One 2-volt I.T. accumulator.
One 5-volt G.B. battery (Siemens).

Top view of the All-Pentode Three.
THE ALL PENTODE THREE

All Pentode

3 Gang Tuning Cond'R...

0.0005 MFD. Each Section

E = Connections earthed to coil chassis.

M.B. = Metallised Baseboard

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Television is uppermost in the thoughts of every keen Wireless Constructor to-day. Great things are happening; greater things are promised in the near future. Soon Television will become a regular part of our daily Broadcast programmes. The question is: how best to equip yourself with a thorough knowledge of practical Television methods of transmission and reception and all the details connected therewith. The answer is contained in this Book.

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All applications will be dealt with in strict rotation. Get yours in at once.
NEW SPEAKERS FOR OLD
Some Interesting Details Concerning the Design of Modern Loud-speakers

By THE PRACTICAL WIRELESS TECHNICAL STAFF

A CAREFUL review of the latest types of speaker seen at Radiolympia this year reveals that the general standard of reproduction has been improved to an almost amazing extent, with the result that the best among modern speakers, allied to the best in modern receiver design, will yield results to satisfy the most critical. These improvements affect almost every aspect of radio reception. In many cases they are so pronounced, and, indeed, so radical in principle, as to render it difficult to classify them and to set them out in logical sequence.

Improved Sensitivity

One of the most striking of the developments is the improved sensitivity of the present-day moving-coil speaker, and more particularly to that of the permanent-magnet type. Without delving too deeply into the mechanics of speaker design it is obvious that the sensitivity depends in part upon the flexibility of the suspension, and in part upon the magnetic field.

In these connections, modern methods of centring the moving coil in the air gap and of supporting the periphery of the cone, give ample axial flexibility to provide a wide range of displacement, while at the same time rendering the risk of the coil getting out of centre a very remote contingency. Thus, one factor in high sensitivity is assured and the mechanical strength of the speaker greatly improved. The second requirement for high sensitivity is the further development of the dual type suspension. In this connection, modern methods are in many cases due to better design of the magnetic field winding. But in the case of permanent-magnet instruments everything must depend upon the design and strength of the permanent magnet itself.

Hitherto, using the best tungsten steel or chrome steel magnets, flux densities have not been greatly in excess of 8,000 lines for the average permanent-magnet loud-speaker. Much of the improvement in this year's permanent-magnet models is the result of the discovery of a new magnet containing carefully balanced proportions of nickel and aluminium. This nickel-aluminium-steel is not only capable of being magnetized to a higher degree than previous types of magnet steel, but it also retains its magnetism better and is not so liable to lose a proportion of its strength after a period of use.

Many makers claim that their new speakers have a density in the region of 11,500 lines. In fact, the modern permanent-magnet loud-speaker is no longer inferior to an instrument of the energized type. Improvement in performance is also in many cases due to better design of the magnet itself, which is specially shaped to reduce magnetic leakage to a minimum.

Better Response

Another important series of improvements has to do with the general quality of reproduction. Even the smallest speakers have an adequate and natural bass response, and instead of a monotonous thump, the bass section of an orchestral performance is a colourful reproduction in which the tones of the different drums are easily distinguished and the distinctive character of double bass and other low-toned instruments stand out in all their realism.

At the other end of the scale, also, response has been greatly augmented, with the result that the somewhat dead reproduction which resulted from full mid-sterile response and deficiency in the upper register has been replaced by a brilliance which enables the characteristic colouration of each instrument in a full orchestra to be reproduced with remarkable fidelity. In addition, improved methods of suspension give that crispness which musicians term “attack.”

These improvements are mainly the result of a better understanding of the principles of cone design and suspension. They are also in great measure due to better design of the chassis itself. Even in the smallest speakers, with the provision of deep girdle section and containing adequate amounts of metal, in a rigid construction, while the larger instruments employ heavy-section castings so proportioned that resonance within the audio-frequency range cannot occur. In some cases, in order to save weight, these castings are made from aluminium.

Another factor which has reacted greatly towards improvement in total reproduction is the further development of the dual type of speaker. The system of employing a large cone, whose duty it is to reproduce mainly the bass and middle range, and a smaller cone charged with the task of reproducing the higher frequencies is not new, but this year is employed by an extended number of manufacturers. In one instance the smaller cone with its driving unit is mounted concentrically on the larger cone, while other manufacturers prefer to use two distinct chassis side by side on a common casting. In all cases, however, a suitable filtering device is incorporated in the output so that the low-frequency component is diverted to the larger unit and the upper register components to the smaller unit in correct proportion to give a faithful and natural reproduction. In some speakers the input to the high note section of the dual speaker can be adjusted to suit the listeners' own personal taste.

Proper Matching

One of the most important factors in speaker application is the question of matching the speaker impedance to that of the output valve or valves. There is at present no complete unanimity among speaker manufacturers as to the most convenient method of arranging for the all essential matching. Three general methods are in vogue. In some cases speakers are supplied with no transformer and are therefore intended to be used

(Continued on page 28)
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NEW SPEAKERS FOR OLD
(Continued from page 26)
with a separate transformer. Other speakers are fitted with a built-in transformer wound for a definite ratio; others, again, have built-in transformers which, by means of numerous tapings, permit a more or less wide variation in the transform-

Dealing first with the instrument which has no self-contained transformer, it should be noted that universal-type transformers for use with such speakers are available in several types. One of the most ingenious is arranged to give no fewer than fifty-eight different ratios by the correct selection among nine terminals only.

The same type of transformer is also built in on certain speaker models, while other makers and models have transformers giving slightly smaller numbers of ratios. For example, one maker fits to his speakers a transformer giving 8 ratios and repre-

Another example of a matching device which gives a large range of impedances.

output valve he employs. On the other hand, speakers with multi-ratio transformers will obviously appeal more strongly to the experimenter.

There are still a number of speakers which are sold with a built-in transformer giving one ratio only. In each case, however, a number of different ratios are made and it is only a matter of specifying the actual value required. Such speakers are, of course, more particularly of interest to the listener who buys or builds a set entirely for serious listening and is not likely to make any alteration to the type of impedance of the load is "tuned" to the optimum load of the valve by a simple switch device. Another useful device embodied in some speakers is a switch which immediately readjusts the load from the value required if the speaker is used as the main speaker to the value necessary when it is used as an extension instrument.

In this broadcasting version an attempt will be made to eliminate not only un-

The section of centring devices.

features of the latest type instruments which make for long life and trouble-free operation. The greater permanence of the present day magnet has already been discussed, as well as the improved design of centring devices.

Television Items

Television "lookers" and listeners old-time programme on September 5th, when Bertha Willmott, John Rorke, Rosalind Wade and her Radiolympia Girls and Sydney Jerome's Quintet will be seen and heard in "For Old Times' Sake," with Eastace Robb as producer.

Droitwich Programme

With the coming of autumn and the opening of the new National transmitter at Droitwich, B.B.C. programmes will undergo a change. Starting on October 8th, some of the programmes will be broadcast on the National and Regional wavelengths between 10.45 a.m. and 6.00 p.m. Monday to Friday each week, and another innovation takes the form of a regular alternative to the late dance band between 10.0 and 11.15 p.m. when a general programme will be broad-

Monsieur Beaucaria"

A novel feature will be produced for West Regional listeners on October 6th, entitled "The Abbot's Way," a trek across Dartmoor. It is described as a radio-drama jaunt written for broadcasting, and listeners will follow the monks' way from Buckfast Abbey across the Moor. Familiar and unfamiliar spots of Dartmoor will be introduced and many songs of old Devon will be sung. The author, E. W. Sanders, wrote the Devonshire episode on the Christmas Day National programme.

Chassis of Cabinet Models

The vast majority of speakers are available in chassis form, but there is a growing number of speakers mounted in a more or less ornamental cabinet. Such speakers in their casings are usually intended as extension instruments in rooms other than that in which the actual receiver is installed. Whether or not there is anything wrong with that position which is most convenient for the receiver itself is not always that most suitable for the speaker either from an acoustic or artistic point of view. It thus occurs that there are many listeners who prefer their speaker to be a unit separate from the receiver itself, and these listeners are fully catered for in this year's models.

In general, these cabinet-type speakers are of fairly simple design, consisting of a square or rectangular cabinet with front fret and protected by the usual fabric. For the most part, the cabinets are well designed acoustically and are free from box resonance. The range of designs, woods, and finishes is sufficiently wide to cover most requirements and there are even models in well-designed bakelite cabinets. There is a notable absence of the use of "fancy" designs and each model is made and it is only a matter of specifying the actual value required.

Promotion

Although he is only 21, Francis Durbridge, of Erdington, has had two sketches and two revues produced by Martyn Webster for broadcasting, and has also written several Children's Hour plays and stories. His first "straight" play in the broadcasting programme "Time's Sake," and the revised version of the first "straight" play in the broadcasting programme "Time's Sake," and the revised version of"Promotion," concerns the rivalry for a departmental manager's job in a big store, and is developed in three episodes. The principal conflict is between an oldish man, who has been with the firm since its small beginning, and the managing director's son, who has become engaged to his daughter. Vincent Curran and Hugh Morton play the father and prospective son-in-law, Cecily Gay, the daughter, and John Lang, the director.
TROUBLE-TRACKING SIMPLIFIED

There are Many Receiver Faults which can be Traced Without the Use of Even Such Simple Apparatus as a Milliammeter, as is Explained in This Article.

ONE of the first things which an enthusiast can learn is the method of tracing faults and minor troubles which can occur in any type of set, whether it is home constructed or ready made. The precise system of testing and of localizing the fault depends largely upon the form taken by the trouble, but there are a number of tests which apply in all cases, and these should be studied first of all.

It is surprising how many really useful tests can be made without the need for any equipment whatever, and without the necessity for dismantling the set or removing any components, once a clear understanding has been obtained of the underlying principles of receiver operation. As an example of this it might be mentioned that it is often possible to tell which valve stage in the set is at fault by merely tapping the glass bulbs of the valves in turn, or by touching their respective grid terminals.

Preliminary Tests

When a set is completely "dead" it is a good plan to switch it on and off quickly, listening for a click as though to hear if it matters. If there is no sound at all the speaker itself might be faulty or there might be a break in the high- or low-tension supply circuits. In the case of a mains set the complete absence of mains hum would probably indicate a break in the H.T. circuit, but in the high- or low-tension supply circuits.

Another very simple test for the valves of a mains set is to feel at the glass bulb of each after the set has been switched on for a few minutes; each should feel distinctly warm, whilst the output valve will almost certainly be very hot if it is functioning properly. If any valve is quite cold, this can be taken as an almost certain indication that the valve is faulty, or that its pins are not making contact with the holder.

Checking Resistances

A very simple test which can be applied to either a battery or mains set after it has been switched on for some little time is to switch off and immediately go over all the resistances, feeling each in turn. If any one is more than comfortably warm it is probable that there is a short-circuit and that the resistance has been passing more current than it should. An examination of the circuit in which the resistance is included will probably lead to a solution of the difficulty. On the contrary, a resistance in an H.T. circuit which is found to be quite cold might easily point to an internal "dis," or to a break in the circuit in which it is placed. Bias resistances in mains sets should receive special attention in this respect, particularly when reproduction is poor, as the output valve becomes abnormally hot, and if the anode-circuit feed resistances or smoothing choke seem unduly hot, without there being any sign of a short-circuit.

Undue heating of the mains transformer in an A.C. receiver generally points to an overload, which might be caused by a faulty bias resistance, a short-circuit in the wiring, or a fixed condenser which has developed an internal short. In the same way, frequent "blowing" of a fuse will often indicate a partial short-circuit, always assuming that the fuse is of suitable value. Generally speaking, the input fuse in a mains set should be rated at 1 amp., or about 2 amps. when the set includes a gramophone motor with automatic record changer. The fuse in the main H.T. positive lead of either a mains or battery set should be rated at about three times the steady current which it is normally required to carry.

Some Causes of Crackling

When a fault shows itself in the form of crackling noises there are three possible causes: the noise might be caused by interferences picked up by the aerial, or by the mains supply, it might be due to a loose contact, or it might be produced by a break in one of the component parts. To find which of these items is responsible the aerial and earth leads should first be removed. After that the set should be tapped in various places, whilst individual components might be gripped and an attempt made to move them; this test will generally indicate the location of a loose connection. If the noise is entering the set via the mains leads it will almost invariably change in intensity or disappear at certain times of the day, so that it can be checked by watching this point. When it is found that the noise is unaffected by

Aerial Lead

any of the tests mentioned it will generally be safe to assume that some particular component is responsible for it. The component which is more prone to give rise to crackles than any other is the L.F. transformer (when it is connected directly in the anode circuit of the detector) and one check can be made by short-circuiting the primary terminals. Even if this entirely stops the troublesome noise one cannot be sure that the transformer is faulty, because the trouble might arise at some point in the circuit previous to the transformer. Nevertheless, it will be an indication that the transformer might well be tested more thoroughly, or that the substitution of another one might be tried.

(Continued overleaf)
Some Historic Events Recalled

What happened in 1910? In another of his broadcasts the Rev. C. F. Lord, First Secretary of the British Broadcasting Corporation, will broadcast on Regional wavelength on September 24th, and on the National wavelength on September 25th, a programme on the work of Captain John Logan, the first man to fly the Atlantic, and on some of the most interesting events of that year. As musical comedy was at its zenith, the first aeroplane flight from London to Manchester was made, Pelissier's Folies were at the height of their fame. The pursuit of Mr. John H. Speckled Band, by Conrad Doyle, was staged at a London theatre. King George V ascended to the throne, and the Olympic was launched. All these events will be recalled in this microphone - "Scrapbook for 1910."

In the year under review such popular musical comedy productions as "The Dollar Princess," "The Quaker Girl," and "The Chocolate Soldier" attracted huge audiences. The first aeroplane flight from London to Manchester was a race staged between M. Paulhan and Mr. Grisnake-White, for which a large national papers offered a prize of £10,000. Starting in the nineties, Pelissier's Folies gradually gained public favor, and after a long season was closed by storm, and in 1910 the famous troupe were still a popular feature of London's entertainment. The nation was thrilled by the launch of Olympic at that time, the largest ship in the world, and looked upon as a wonder of the ocean. The concert between Candian-Welt and Starliner No. 534, which will be launched at Clydebank on the day following the repeat broadcast of this programme, is very striking. The Olympic was hardly a quarter of the size of 534. New Light Orchestra

The New Light Orchestra will be heard again by Scottish Regional listeners on September 26th. The conductor will be Ian Whyte, and an interesting feature of the programme will be the performance of the "Straw Suite," by Waugh Wright. The soloist will be John Curnow, who will sing two groups of songs—denied entirely to songs of the sea.

The Launching of "534"

One of the most important broadcasts of the year takes place on September 26th, when Her Majesty the Queen will perform the launching ceremony of the new Cunarder. In addition to the actual ceremony, listeners will hear speeches by His Majesty the King and Sir Percy Bates, Chairman of the Cunard Steamship Company, and a full description of the event at the shipbuilding yard will be given.

Harry Kemp's Summer Show

A SCOTTISH Regional variety programme will be given on September 25th, when an excerpt from Harry Kemp's "Summer Show" at the Barrfields Pavilion, Blackpool, will be relayed. The artistes taking part in this programme need no introduction to listeners, for all the members of this well-known cast have already been heard on the air several times already during the summer months. This relay concludes the summer broadcasts from popular holiday resorts.

The Old Parish Church

CORSTORPHINE Old parish church, Edinburgh, from which a religious service will be broadcast on September 23rd, has a long history. It is known how long the site has been dedicated to the worship of God, but a chapel was granted by King David I to the Abbey of Holyrood in 1128, the date of its foundation being unknown. Several buildings have been taken place, but a votive chapel, dedicated to St. John the Baptist, which was built in 1405, is now represented by the chancel of the present church. In 1895 extensive restoration was carried out, and the church now represents as nearly as possible the original collegiate church as constructed in 1425.

A Self-taught Organist

CECIL CHADWICK, the organist of the Classic Cinema, who recently gave his one hundredth broadcast recital, always permits his wife to draw up the programme for his recital on his birthday. Mr. Chadwick was originally a mill worker, and as far as the organ is concerned he is a self-taught player. He confesses to a whole-hearted dislike to mills and everything pertaining to them.

Symphonic Variations

A NEW work by Clifton Helliwell, called "Symphonic Variations," which was first performed last season at one of the public concerts in Belfast, will be broadcast by the Belfast Wireless Orchestra in its concert on September 21st. This is Mr. Helliwell's first essay into the realms of serious music, though he is better known to Northern Ireland listeners for his syncopated numbers and his adaptations of operetta.

A Pianist at Three

THE Manchester Tuesday Mid-day Society opens its season on September 26th with a recital by John Davies, a young Manchester pianist. His mother relates that Davies could play the piano by ear at the age of nine, but that it was not until five years later. Subsequently he studied at the Manchester Mayday School, at the Hochschule fuer Musik at Berlin, and under Landm. Now but twenty-four, he was featured at a Manchester municipal concert in September. Broadcasting from the Houldsworth Hall, Manchester, on September 25th, he will play works by Brahms and Chopin.

The Bouquets' Farewell

THE Bouquets Concert Party, presented by Murray Ashford, are broadcasting a farewell programme from the Spa Theatre, Scarborough, on September 25th. On September 27th a farewell show by Ernest Binns' Arcadian Follies will be relayed from the South Pier, Blackpool, and, immediately following, Captain Amers' Orchestra will broadcast a programme of popular music from the Royal Hall, Harrogate.

Uncle Eric's Goodbye

ULEE ERICS last public appearance in the Northern Region Children's Home is fixed for September 26th. He then goes, as Mr. Eric Fog, to London to take up his new post as a famous radio conductor. The League of Helpful Unices, of which he has hitherto been a prominent member, has arranged to give him a grand send-off in a programme which will include many old favourites.
I forewarn that you may be forearmed. I tell you at a glance the exact state of my charge and there is nothing to memorise. You can depend on what I say. If I report "Full," then I am full. I am a sure safeguard against the nuisance of being caught unawares by a run-down battery. No need to run that risk. Have an Exide "Indicator" Battery.

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Where the Home Constructor Scores

In this Article the Author Points Out the Many Advantages the Amateur Set-builder Has Over the Owner of a Ready-made Receiver

In one or two quarters it has been mentioned that the heyday of home construction is passing, and that there is little or nothing to be gained in making a radio receiver in the home. Let it be stated right at the beginning that nothing can be more erroneous, for in dozens of ways the amateur constructor is at a great advantage over the owner of a mass-produced commercial receiver.

Consider first the question of freedom of choice which the constructor possesses. The purchaser of a ready-made set must take exactly what the manufacturer has made. A certain set may be just what he needs from the technical point of view, but it may be too big to rest on his wireless table or its cabinet may be quite out of harmony with the remainder of the furniture in his home. Or he may see a receiver which would be quite an ornament to his living-room, but its specification may be quite unsuited to his technical requirements. The amateur, however, can please himself in every direction. He can build a set to meet his individual needs—a family set, a DX fan's set, a short-wave set, a transportable—and he can mount it in a cabinet of any shape or size, and of any finish to harmonize with its surroundings. He can build it into an existing piece of furniture or tuck it away among the books on his bookshelf. He can incorporate a clock in the set, and can indulge in any fads or fancies in technical design or in appearance.

Keeping Pace with Development

In the modern small home, where space is a premium, this is a point worthy of serious consideration. Moreover, a cabinet used for a previous receiver can be pressed into service, thus saving considerably on the cost of maintaining the radio equipment in line with modern technical practice.

So rapidly do technical developments arise that practically any commercial receiver is quite obsolete three years after it is made, and many sets are at least obsolescent in a twelvemonth. But the home constructor can modify his set whenever he likes and so keep abreast of the times. He need not even wait for his equipment to become obsolete, for the latest developments can be introduced, if he so desires, immediately they are announced—or may be postponed just as long as he wishes. Moreover, remodelling a home-built set does not involve scraping the whole of an expensive outfit. The replacement of a coil or condenser, or of a valve, the re-arrangement of a circuit, and re-designing of an individual stage, all can be done while retaining all the remaining portions of the set. Such renovations can also be carried out by installments, as and when convenient to the leisure and to the pocket.

Examples of improvements which can be made in this way could be multiplied indefinitely, but it must suffice to mention only a few. Figs. 1 and 2 show how simple it is to replace an ordinary screen-grid valve or high-frequency pentode by a variable-mu valve in the high-frequency stage in the case of a battery set. The arrangement for a mains set, although not quite so simple, since it involves a resistance network to give the correct screen voltage and variable automatic bias, is perfectly straightforward and the connections are shown in Fig. 3. Again, a neat device for changing over from one to the other to leaky-grid detection is illustrated in Fig. 4, but none of these conversions would be possible in the average mass-produced set.

Greatest of all among the points whereon the constructor scores is that with a home-built set he can definitely experiment. He can try any device he pleases, which is quite impossible with a commercial receiver, and generally speaking the benefits of experimenting are threefold. By conducting tests of all descriptions the amateur gradually builds up a wealth of knowledge concerning the technicalities of radio in a way which is far more rapid and far more certain, than can ever be possible by mere reading and study. Many amateurs have found it impossible to draw a circuit diagram, or even to read one until they had built one or two sets and experimented with them. Thereafter, technical diagrams were no longer a sealed book, and they were able to follow articles and descriptions which previously were quite incomprehensible to them. Added to this, radio experimenting is a source of real pleasure, a fascinating hobby and a highly intellectual pursuit. Finally, the experience of the satisfaction of knowing that his receiver can always be in fashion, always up to date, always at the height of efficiency, always complete, yet never finished.

A Few Suggestions

With regard to experimenting there is very much still to be learned about automatic volume control—simple A.V.C., amplified A.V.C., amplified and delayed A.V.C., and automatic volume control combined with a carrier noise suppressor. The number of possible circuits is legion, using double-diode-triodes, Westectors, separate double-diodes and so forth. There is also, thanks to the new battery operated double-diode-triode, ample scope for the investigation of A.V.C. in battery-operated sets. One of the simplest arrangements is that shown in Fig. 5.

Then different forms of output stage can be tried—triode, pentode, quiescent push-pull, class "B," and so forth—while methods of tone control, in order to achieve high quality, is another fruitful field for research.

To carry out even a minor repair on a modern factory-made receiver is not impossible. Most of the essential components and connections are inaccessible and frequently special tools are required. Selling is the complete circuit diagram of the receiver available, and there is always the threat if unauthorized repairs are undertaken the receiver is no longer covered by the maker's guarantee.

The constructor, on the other hand, has no difficulty about repairs. You see, he knows his set, having built it. He knows just what each component is and where to find it; he knows the runs of the wires, and remembers the little places where he had difficulty when making up the set.

(Continued on page 34)

Figure 1: The normal connections for a battery-operated H.F. pentode.

Figure 2: The simple modifications necessary when changing over to a variable-mu H.F. pentode stage are shown above. The potentiometer should have an "off" position, otherwise a 3-point switch is necessary.

Figure 3: Necessary connections for a mains variable-mu H.F. stage. Component values will depend upon the valve employed and H.T. available.
He also remembers spots where breakdowns are likely to occur, and components about which he had previously had suspicions. Moreover, his set is accessible, for he has built it with the object of pulling it to pieces and remodelling again and again. All repairs that he can undertake himself, he has not to wait while the set is sent to a service depot, and he does not even have to rely upon the tender mercies of his local dealer.

Conversions

Another point is that people change their place of abode. Where previously they had to rely on batteries they may now have the boon of electric mains. Where once their receiver, carry the normal anode current of the battery receiver is in the lead joining the mains -driven receivers specially de- signed for use on any electric light system. If the set is ultimately to be used on an A.C. supply there will be a considerable saving in the cost of conversion by reason of the fact that with universal valves, no power transformer is required.

Finally, there is one great point on which the constructor scores over the purchaser of a complete receiver. This is the thrill which every constructor experiences when he has built a set that really works. It may not be that the home-made receiver is quite as efficient as or as neatly built as the best commercial sets of similar design, but it is quite conceivable on the other hand that it may be much better. In any case, the builder knows that it is the work of his own hands and possibly, to a greater or less extent, the product of his own brains. There is a wonderful thrill in that, a fact which all new readers of Practical Wireless can prove for themselves by making up the "Star" set described in this issue.

THOSE ODD "BULBS"

An Interesting Description of the Incidental "Lamps" in Radio Receivers, which Include Fuses, Dial Lamps, Barrellers and Tuning indicators. By H. BEAT HEAVYCHURCH

FUSES are desirable in many positions in the modern set. For powerful mains-driven receivers specially designed with fuses enclosed in glass tubes and housed in batellic car- riers are strongly recommended. In battery-operated sets however, and also in certain positions in the mains set, lamp bulbs of the ordinary flashlamp type are perfectly satisfactory. The correct position for such a fuse in a battery receiver is in the lead joining the H.T. terminal to the L.T. terminal, and the object is, of course, to safeguard the valves from destruction in the event of an accidental connection between any H.T.-L.T. lead and the filament wiring.

The diagram of connections reproduced in Fig. 1 makes it clear that any current derived from the H.T. battery and circulating in the valve filament circuit must pass through the fuse bulb. For general use in this position an ordinary 31-volt flashlamp rated to carry 0.15 ampere will be found most suitable, for it will easily carry the normal anode current of the receiver, but will " blow" before any excessive current can damage the valve filaments.

Dial Lights

The illuminated dial has two great advantages - it facilitates the accurate setting of the tuning condenser and it also indicates whether the set is " on " or " off," thus providing a warning to the listener to switch off before retiring.

In choosing a bulb for a dial light it should be remembered that the ordinary flashlamp bulb is not designed for continuous operation at its rated voltage, but is only intended for intermittent flashing. Select therefore a bulb for a voltage higher than that of the low-tension supply. Thus, for a battery set using a 2-volt accumulator, a 31-volt bulb should be used.

In addition to ensuring a reasonable life for the dial lamp, considerable economy in battery consumption will result, for a bulb rated to consume 0.3 ampere at 3.5 volts will only take approximately 0.2 ampere on 2 volts.

In the case of an A.C. mains set, the filament transformer of which gives 4 volts, a bulb intended for a 6-volt or 61-volt supply should be used for the dial light. Such a bulb, normally taking 0.3 ampere will only consume 0.2 ampere in the set when operated at 4 volts. If your set is of the universal type or of the D.C. mains type having the heaters of the valves connected in series, it is convenient to connect the dial lamp also in series with the heater circuit. In this case it is necessary to ensure that the bulb is rated to carry continuously at least the full current of the valve heaters. Most modern universal valves have 0.2 ampere heaters, but some manufacturers have adopted 0.3 amperes. There are suitable flashlamp bulbs for each type. 6.0 volt 0.3 ampere lamp being recommended for the 0.2 ampere heaters and a 0.5 volt 0.3 ampere lamp for the 0.3 ampere series. Bulbs of the above ratings will carry the full heater current with safety and should give a burning light of about 1,000 hours.

Some listeners find the white light from an illuminated dial somewhat annoying - bright lights have a kind of fascination for some people, and should be avoided. This can be remedied by giving the dial lamp a coat of coloured varnish. Green is the most restful colour, but red or orange also give excellent results. Quite good results can also be achieved with coloured gelatine or even with coloured crepe paper interposed between the lamp and the tuning dial.

Tuning Indicators

In the interests of high quality reproduction it is important that when listening the set should be accurately "on tune." If the set is fitted with automatic volume control judgment on this point is difficult because, when the set is "off tune" the

Fig. 1.—Indicating the correct position for a fuse in a battery set.
automatic volume control feature will bring up the volume to maximum. Fortunately, devices have been developed which give a clear visual indication when a station has been accurately tuned.

Two main types of visual indicator are available. In the first and simplest an ordinary electric lamp bulb of the flashlamp type is employed and a shutter is located between the light and a screen on the panel. The shutter is operated by the anode current of one of the receiving valves—usually a high-frequency or intermediate-frequency amplifier in a set having automatic control, but sometimes the detector valve. The movement of the shutter alters the shape or size or position of the beam of light falling upon the screen, thus showing whether the set is accurately tuned or not.

The second type of luminous tuning indicator makes use of a neon discharge tube, which is again actuated indirectly by the anode current of one of the valves. The neon bulb for this purpose is of such a value that when the resistance of one of the H.F. or I.F. valves, or intermediate-frequency valve is flowing in the normal mains receiver gives about 50 volts. The usual method of employing the indicator tube is to connect the cathode to the anode, which is sufficient to cause a light to appear on the face of the tube. The neon bulb is of such a value that when the resistance of one of the H.F. or I.F. valves, or intermediate-frequency valve is flowing in the normal mains receiver gives about 50 volts. The usual method of employing the indicator tube is to connect the cathode to the anode, which is sufficient to cause a light to appear on the face of the tube. The neon bulb is connected in parallel with a potentiometer with one fixed tapping connection to the indicator tube. The usual method of employing the indicator tube is to connect the cathode to the anode, which is sufficient to cause a light to appear on the face of the tube. The neon bulb is connected in parallel with a potentiometer with one fixed tapping connection to the indicator tube.

The first type of visual indicator with which we are concerned is that in which the bulb is filled with mercury. When, owing to reception of a carrier signal, the automatic control feature of the receiver comes into action, the anode current of the H.F. or I.F. valve is gradually reduced as the set is brought to a new frequency. The reduction of the anode current decreases the voltage drop in the anode decoupling resistance and thus increases the voltage applied between the anode and cathode of the indicating tube. The area of glow therefore increases and the circuit is so arranged that the point of optimum tunedness coincides with the maximum length of the glowing column. A conventional diagram showing the essential connections for this arrangement is shown in Fig. 2.

Barretters

In universal sets, and also D.C. mains sets in which the heaters of the valves are connected in series across the lighting mains, some form of resistance is also necessary in the circuit in order to absorb the difference between the total mains voltage and the voltage required to drive the rated filament current through the heaters. Thus, with the new 0.2 ampere nominal, 13 1/2-volt A.C. valves a 4-valve set actually requires only some 85 volts across the filaments, namely: 13 volts each for the two high-frequency valves and detector; approximately 26 volts for the output pentode and some 20 volts for the rectifier. If the set is operated on a 200 volt circuit approximately 116 volts remain to be absorbed by the bulb resistance and a rather larger value if the mains voltage is 230 or 240 volts. It is, of course, not difficult to calculate the correct value for a wire-wound resistance for this purpose, but such a resistance would only be suitable for one definite mains voltage. Moreover, commercial lighting systems are subject to considerable voltage variations during the day, and a fixed value resistance cannot automatically compensate for these variations.

In place of a wire-wound resistance, a barretter or regulator lamp is usually connected in series with the heater circuit. A barretter is a thin filament, usually a single gide of iron wire, enclosed in a bulb filled with some gas such as hydrogen. This combination has the property that its resistance will vary according to the current passing through it at a substantially constant value, even though the voltage applied to the circuit varies over fairly wide limits. Barretters are available for use with the 0.3 and 0.5 ampere series-running valves and also the older 0.18 and 0.25 D.C. valves. Each is available in various types to cover different voltage ranges. A skeleton circuit of the heater arrangements for a universal set is given in Fig. 3, and shows where the barretter should be connected.

Voltage Regulators

When a radio receiver employing quiescent push-pull or class B amplification is operated from a mains high-tension unit, very considerable variations in high-tension voltage occur on account of the very large fluctuations in anode current in the output stage. These voltage variations are due to the fact that the internal resistance of the ordinary vacuum type regulator lamp is very very high. Two ways of minimizing these fluctuations are available. The latest, and probably the best, among these is the use of a regulator lamp in which the bulb is filled with mercury vapour. Such a rectifier has a very low internal resistance, and the output voltage of a high-tension unit in which such a rectifier is employed remains constant within close limits at all loads. Alternatively, an ordinary type of rectifier can be employed, and a neon stabilizer tube connected across the H.T. output. The voltage stabilizer may be considered as a kind of high-capacity condenser having a low breakdown voltage which will maintain the voltage substantially constant, taking a heavier discharge when the voltage tends to rise and thus reducing the voltage to a normal mean value.

Fig. 2.—Conventional diagram to show the operation of a neon visual-tuning indicator.

PRACTICAL WIRELESS

Fig. 3.—Heater circuit for an A.C./D.C. set showing the position of barretter.

September 22nd, 1934

"I Want to Abolish"

THE series of discussions entitled "I want to Abolish," which begins on October 1st, is certain to arouse a great deal of comment through the country. Mrs. Catherine Carswell will open the series with a strong plea for the abolition of Burns Nichts. Those listeners who read her recent book on the poet will know that Mrs. Carswell knows her subject thoroughly and is not afraid of speaking her mind. Sheriff J. G. Jameson, who will defend Burns Nichts, is also an expert on Burns, and has had the advantage of presiding at more Burns Nichts than he can remember. Other discussions of an equally controversial character will be broadcast at fortnightly intervals.

Pleasie Colliery Band

THIS well-known band comes to the Birmingham studio from a pit in the Mansfield district for its first broadcast on October 2nd. Most of the bandsmen work on the coal-face. Bert Lambeth has been the conductor since 1924, and his son, Leslie, plays a cornet solo. This band has won nearly £2,000 in prizes.

Back in Town

ENGAGEMENTS with seaside concert parties have prevented several radio favourites from coming to the microphone for some considerable time. Listeners may remember that a few of these artists made a fleeting visit to the studio on June 12th in a programme entitled "Out of Town To-night." Now that the holiday season is fast drawing to a close, Charles Brewer is preparing another programme on similar lines to conclude the series of concerts returning from the seaside. This will be broadcast on October 8th, on the Regional wavelength, under the title "Back in Town," and will be of a high-speed nature, representative of concert parties on the South and East coasts.
The Methods of Carrying Out Systematic Tests of a Superhet, are Described In This Article.

A SHORT time ago, in an article entitled "Superhet. Pointers," I explained some of the minor difficulties which are likely to crop up when building a superheterodyne receiver. Since that article was written, correspondence has shown that many of those who construct superhets are in an absolute quandary if reception is not immediately forthcoming. Many readers who are perfectly conversant with the general systematic method of testing through a "straight" receiver do not appreciate either that an almost identical procedure may be followed, or that certain valve stages can easily be eliminated.

It has been explained in these pages before that in making stage-by-stage tests of a "straight" set the idea is to cut out the low-frequency and high-frequency valves one at a time, working toward the detector. The actual method is slightly different in the case of the superhet, because there are two detectors, but it is possible to work toward each of these in turn.

For example, if nothing can be received, or if there is a persistent crackling or other fault, the first step should be to eliminate the L.F. valve by connecting the speaker (a pair of "phones is better, when available) in the anode circuit of that valve in the position marked A in the circuit diagram, Fig. 1. The anode circuit of the oscillator valve should then be broken and an attempt made to tune in the local station. Signals will, naturally, be weak, but the station should be heard; if not, the valve or its associated tuning circuit is probably at fault. If a band-pass tuner is employed it will be desirable to eliminate one tuned circuit by connecting the aerial direct to one end of the grid coil. The other tests will be exactly the same as when a "straight" set is being dealt with.

The second detector can most readily be tested by breaking the connection between the secondary of the intermediate-frequency transformer and the grid condenser, and connecting the latter point to the aerial-tuning circuit, after disconnecting the grid of the first detector. (In the case of a mains receiver, and when the first valve functions on the anode-bend principle and has a high anode voltage, it is best to connect its grid direct to earth to avoid the flow of too great an anode current.)

This test covers both the preliminary tuning circuit and the second detector, whilst the L.F. amplifier can also be brought into use in addition. If it is found that the first and second detectors and also the low-frequency portions of the receiver are functioning correctly, only the oscillator and intermediate-frequency amplifier remain. The next step, therefore, should be to check the oscillator. This can be done by replacing the broken oscillator connection, connecting the grid of the first detector to the tuning circuit and joining the grid condenser of the second detector to the first I.F. transformer, removing the lead from this to the grid of the first L.F. valve.

Fig. 1.-A typical Superhet circuit used to illustrate methods of testing described in this article.

(Continued on page 42)
A NEW and MIGHTY AERIAL
Most wireless receiving Sets to-day are so highly sensitive that only very short aerials are generally necessary, but this sacrifice stability. When the Aerial is a short one, your Set will be more selective, but it may be unbalanced, on the verge of oscillation, and hard to control. The new ELECTRON GLOBE AERIAL remedies this and restores balance to the set, corrects fading and 'blasting,' as the set is so easily controlled and maintains selectivity at a higher efficiency.

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Amplified Physical Jerks

Ten thousand gymnasts, men and women, performing exercises in perfect unison to music on a twenty-acre field—that was the imposing spectacle recently staged in the Strahov Stadium, Prague, by the Third Workers’ Olympiad. The military precision of the serried ranks of athletes was made possible largely owing to the orchestra of 120 musicians amplified by a Philips installation and heard by 120,000 spectators.

The amplifying apparatus included twenty-four horn loud-speakers, 6ft. long, and four 120-watt amplifiers. In addition, a “Maxivatt” amplifier was used by the Philips engineers for offsetting the difference in sound volume due to the direction of the wind.

The success of this experiment is considered by experts to prove that there is no enclosure too large to receive distinct amplification, provided that sufficiently powerful apparatus is used.

Mr. Grierson’s Flight

The Marconi Company received recently the following telegram from Mr. John Grierson, the British airman who has just completed a flight from London to Iceland, Greenland and Hudson Bay. “Marconi receiver and transmitter never failed to function. Only regret unable make full use wireless owing difficulties solo piloting. Transmitter probably saved my life on east coast Greenland. Wireless proved indispensible to such a flight.”

Mr. Grierson’s aeroplane was fitted with a Marconi short-wave transmitter covering a waveband of 30 to 50 metres, and a receiver with a “homing” device attachment as an aid to navigation.

American Stratosphere Ascent

With reference to the stratosphere ascent made in South Dakota, U.S.A., during July, it is interesting to note that Ferranti Class “B” input and output transformers were employed in the short-wave transmitter which was used in the balloon for communication purposes.

The equipment was supplied by the Ferranti Company through the National Broadcasting Company of America, and the transmitter with Ferranti Class “B” transformers is now reposing in the National Broadcasting Company’s Museum.

Pifco—New Address

The Provincial Incanteric Fittings Co., Ltd., best known by their trade mark, Pifco, the word being made up with the initials of the registered title of the company, manufacturers of the well-known electric cycle lamps, testing instruments for radio, heating stoves, and other electrical apparatus, announces that it has moved far enough away from the theatre, the W.B., to Stentorians were allowed to live up to their name without disorganising the Exhibition arrangements.

A Critic Retracts!

One of the most critical letters yet received at Belfast arrived in the B.B.C. office there recently. It was from a listener who expressed himself “disgusted” with a certain programme. Its contents were duly noted. In the afternoon it was followed by another letter from the same writer, entirely withdrawing his first remarks, apologising and requesting that the original letter might be destroyed! What was the reason?

The Highest Radio in Great Britain

We have heard of radio receivers in coal mines, diamond mines, and numerous other places below the earth’s surface, but information comes to hand of the latest effort of a Marconi man—Mr. G. S. Wakeham, 22, High Street, Llanberis. Mr. Wakeham managed to interest a director of the Mount Snowdon Railway in the pleasures of radio listening, with the result that this gentleman became fired with enthusiasm and determined to provide entertainment for visitors at the Summit Hotel, Snowdon. Mr. Wakeham was given to understand that whatever was installed had to be first class quality and of good appearance; there was to be no outside aerial, as this would detract from the surroundings of the hotel which are particularly beautiful. He therefore took a Marconophone Model “273” via the Snowdon Mountain Railway and installed it in the Summit Hotel at the top of Mount Snowdon. An inside aerial was hung from the wall inside close to the roof, and the only earth that could be obtained was a certain amount of sheet iron which formed the framework of the building. The ordinary “ground” was impossible, the foundations being of solid rock. Reception is reported as being splendid, dozens of stations coming in at full loud-speaker strength.

MASSED GYMNASIUMS.

A wonderful demonstration of massed drill—controlled by loud-speaker commands. See the paragraph on this page giving details of this novel Philips demonstration.

September 22nd, 1934
SUPPLEMENT TO "PRACTICAL WIRELESS"

AMATEUR TELEVISION

CATHODE-RAY TUBE SCANNING

By H. J. BARTON CHAPPLE, B.Sc., A.M.I.E.E.

ALTHOUGH the methods of controlling the scanning spot appear to be understood by readers interested in television, the cathode-ray tube is not so generally understood. Whereas with discs, drums, etc., the movements of the parts can be watched, in the case of the cathode-ray tube such a course is not possible.

C.R. Tube Electrode System

Take the tube itself and examine the bare essentials of the electrode system. This is shown in Fig. 1, which illustrates an ordinary filament (the cathode) which is heated by an electrical current, so that a stream of electrons is emitted from the filament surface just as in any ordinary valve. Completely surrounding the filament is a small diameter metal cylinder. This is termed the control cylinder or "gun," although in many cases it is known as the Wehnelt cylinder, after its inventor. This cylinder has applied to it a negative charge, so as to concentrate and direct the stream of emitted electrons towards the circular disc or anode mounted just in front, as seen in Fig. 1. In practice the incoming television signals are applied to the plate at an enormous speed, and as at the centre of the plate a small hole is made, a large proportion of the electrons pass right through this hole and continue unchecked until they reach the front screen, where their high velocity renders them visible as a spot on the fluorescent material with which the screen is coated.

Spot Movement

This is really equivalent to the stationary scanning spot utilized in mechanically-operated receivers when the scanning mechanism is at rest. Interposed in the path of the electron stream between the anode and the screen, however, are two pairs of plates at right angles to one another. These are called deflector plates, and when no voltage is applied to either pair the electron path is normal to the screen. If, however, either pair or both pairs of these plates are given an electrical charge it will have the effect of diverting the electron stream from its previous straight path so that it "bends" and strikes the front fluorescent screen at another point. Furthermore, the amount of deflection imparted is proportional to the potential charge given to either or both pairs of plates.

Here, then, is a method for making the spot describe a definite predetermined path, provided the potentials on the plates can be traced by the electron beam as the conditions imposed by the scanning spot movement at the transmitting end. First of all, each pair of plates is connected to a separate frequency generator. With all scanning processes there is a primary and secondary movement, the first depending upon the number of lines into which the picture is divided, and the second upon the number of picture repetitions per second. For example, with the B.B.C. television service the primary movement takes place 575 times per second (125 pictures per second multiplied by the 25 scanning stripes), while the secondary one is 125 per second. On the other hand, with the higher definition images which are now being investigated the frequency is altered, being 4,500 in the case of 180-line pictures for the primary motion and 25 for the secondary motion, respectively.

Saw-Tooth Motion

In the former case the spot has an upward movement at a steady velocity, and when it has reached the top of the scan a "quick return" is made to the bottom of the light field being explored, when the process is repeated all over again except that the path followed is next to the one previously described. With most high definition processes the same effect takes place, except that scanning is horizontal instead of vertical, but in both cases the movement

Fig. 1.—Showing the bare essentials of a cathode-ray tube's electrode system.

Fig. 2.—This graph illustrates the saw-tooth motion of the television scanning spot.

Fig. 3.—The heavy and light lines show how the scanning field is built up by the time bases.

Fig. 4.—An example of a well-designed double time base for controlling the cathode-ray beam movement. The scanning rates can be altered quite easily and this is one of the distinct advantages of cathode-ray tube working for television reception when it is desired to change from one light area shape to another, or adjust the scanning lines for low- or high-definition transmissions.
effective ways of carrying this out is to use a thyratron or gas-filled discharge tube.

A "Triggered" Effect

These tubes resemble somewhat an ordinary valve in appearance but the electrode construction, and gas filling, cause them to function in a different manner. The usual grid volts/anode current curve is not followed, but the grid voltage can be fixed at a certain prearranged figure above which no anode current will flow. The moment the grid voltage falls below this value, however, the full anode current flows immediately, or in other words the anode current is "triggered" by the fall in grid voltage.

A circuit is therefore arranged—commonly known as a time base circuit—which in its simplest form is merely a saturated diode valve. To this is connected the biased gas-filled discharge tube and a fixed condenser in such a way that a uniformly increasing potential is applied to a pair of the cathode-ray tubes deflecting plates. This deflects the electron stream in a proportionally uniform manner, so that the original stationary spot now describes a vertical or horizontal line on the fluorescent screen, according to which pair of plates the time base circuit is joined. The thyratron is arranged to trigger at the moment when the deflector plate voltage is sufficient to divert the stream the required scanning distance along the strip. At this instant the tube causes the voltage to drop to its initial value almost instantaneously (corresponding to the vertical drop in the saw-tooth graph, Fig. 2) and the cycle of operations starts again, to continue for such time as the time base voltage supplies are maintained.

A Second Time Base

At the same time that this line traverse or primary scanning operation is taking place another action is imposed on the second pair of deflector plates. This corresponds to the pictures per second traverse, and is at right angles to the first operation. Either 24- or 25-frequency time base circuit is made to function, and obviously its action is to pull down (horizontal scanning) or pull across (vertical scanning) the spot so that each line traverse (horizontal scanning) or pull across (vertical scanning) the spot so that each line traverse is not over the same path but contiguous and obviously its action is to pull down (horizontal scanning) or pull across (vertical scanning) the spot so that each line traverse is not over the same path but contiguous one to the other. As the field of light is therefore traced out on the fluorescent end of the tube; this second time base action persists until at the end of the last scanning line the second thyratron is triggered and a "fly-back" stroke is made to the starting-point once more. If the whole of this scanning operation is imagined to be pulled out somewhat it will appear as in Fig. 3.

An Advantage

Although simple in theory the time bases call for very careful design in actual practice. Usually they are built up in "double" form to allow one unit to perform the dual function, and in Fig. 4 is shown an example of a unit of this character. The two thyratrons are in the centre, being flanked by the saturated diode valves, while on the panel are the controls which determine the frequency of the action and the length of the scanning strokes.

Being a voltage-operated device but little power is consumed by a cathode-ray receiver; indeed, quite small-size high-tension batteries are marketed specially for this class of work.

The clean finish and quality of Hivac productions are strongly emphasised in the embossing of Hivac Anodes not only with the letter "H," but also with horizontal and vertical channels. These add to the strength of the structure and constitute a safeguard against buckling. This care in construction is responsible for the consistent characteristics of all Hivac valves.

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TRACING FAULTS IN SUPERHETS

(Continued from page 30)

of a multiple valve is not functioning, due either to the lack of H.T. voltage or a break in one of the windings of the oscillator coil. These items should therefore be tested in the conventional manner before proceeding further. As a check on the I.F. transformer it might in some cases be found convenient to change over two of the transformers in the set.

If it is definitely established that the oscillator valve is at the root of the trouble, no good purpose can be served by leaving one or more of the I.F. valves out of circuit, and they should therefore be re-connected. When the receiver is being tuned by a multi-gang condenser it might often be found that the oscillator section is not tracking correctly, because of a fault in the coils or because the condenser plates are not of correct shape. In either instance the best check is to connect a single variable condenser in place of that section which operates upon the oscillator coil, this must be tuned at the same time as the gang condenser, and if it is found that signals are much louder with the new connections it will be evident that one of the faults mentioned does actually exist.

I.F. Troubles

When it is found that the oscillator is functioning correctly, and after following the series of tests described, there will be nothing left to suspicion except the I.F. stages. If there is only a single stage, all altered connections should be re-made to conform with the original circuit. Check the voltage on the anode of the valve, and also test the windings of the transformer for continuity. Where there is a variable-mu control, this should be eliminated by short-circuiting the variable resistance, in the case of a mains set, or disconnecting the lead to the centre potentiometer terminal and joining the lower end of the transformer secondary to earth in the case of a battery receiver.

If there are two intermediate-frequency stages the second can be eliminated by joining the grid condenser of the second detector to the grid terminal of the second I.F. transformer, removing the lead which normally goes from here to the grid of the I.F. valve. The same tests as were described above in respect of a single I.F. stage set can then be applied before bringing both intermediate-frequency stages into use.

The above instructions have necessarily been of a general nature, and reference has chiefly been made to circuits incorporating a separate oscillator valve and a triode detector. Some of the details will differ slightly when more modern circuits designed around multiple valves are being dealt with. Nevertheless, the principles will be the same, and a similar method of systematic testing can be employed. When the first detector is preceded by an H.F. stage, the latter can be eliminated exactly as in the case of a "straight" receiver, by transferring the aerial from the first to the second tuned circuit.

Do You Know What This Graph Means?

The man who can analyse these curves and understand what they indicate knows his job. But if they do not convey to him perfectly definite information, it would appear that he needs more training than he has had. He is not competent to fill a responsible position in wireless.

Radio has developed so rapidly throughout the last ten years that it has now greatly outgrown the supply of technically qualified men required for the better posts. Moreover, it continues to develop with such speed that only by knowing the basic principles can pace be kept with it.

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September 22nd, 1934

2/6

PRACTICAL WIRELESS
Lissen Iron-core Coils

THE Lissen iron-core coils are, of course, well known to our readers, having been specified in some of our constructional articles. Formerly these were only obtainable in the form of a rather bulky nature, in the deep base of which was included a wave-change switch mechanism. This method of assembly is, of course, admirable when it is desired to use two or more coils in a circuit of a rather compact and efficient nature, as the apparatus may be constructed with its external switch wiring, and thus instability avoided. For the benefit of those who wish to use this type of coil with an external switch, such as one of the multiple switches which are now on the market, Messrs.

Clix Master Plug

IN last week's issue we gave details of a new master plug which had been introduced by Messrs. Lectrolinx, Ltd., and which was designed to accommodate much larger gauges of wire than the existing types of plug. We now understand from Messrs. Lectrolinx that this particular plug may be obtained in red as well as black. The price, as previously mentioned, is 3d.

“A Coil That is Wanted”

IN our issue dated August 25th we dealt with various tuning schemes, and on page 666 we stated, under the above heading, that there was a need for a coil which would operate satisfactorily with the battery-fed heptode valve. Messrs. Colvern point out that their 0.8 coil is designed for use with either a triode or a pentagrid type of oscillator, and that it will function quite satisfactorily with the battery-operated heptodes which are now available. This coil is of the iron-core type and the windings are balanced to provide adequate oscillation over the complete wave-band with the majority of superhet circuits which are now available. It may be used with a ganged condenser having a shaped oscillator section, or with a straight gang condenser and a separate series padding condenser.

B.T.S. Screened Connector

A NOVEL connecting lead has been received from British Television Supplies, and is illustrated on this page. This consists of a thin connecting wire, to the ends of which are soldered some stout ring connectors. This wire is surrounded by a porcelain tube which is shaped somewhat after the manner of a string of small beads. Surrounding this is a spiral of springy metal, each turn of which locks over the preceding turn and, owing to the springy nature, the whole remains quite rigid and grips firmly in a connecting link which is provided for an earth connection. By gripping the two ends of the device and twisting, the spiral covering is reduced slightly in diameter and the earthing clip is thus free to be moved to any desired position for convenient earth connection. As a further useful feature the small beaded tube may be easily fractured by bending the lead, and thus the complete device may be shaped to fit between any convenient points and it will not be liable to move and thus upset any ganged tuning adjustment. Or otherwise give rise to troubles from the movement of the connecting lead. The sketch shows the various points which are mentioned above, and also gives a very good idea of how the connector may be used to link an S.G. or H.F. pentode valve to a choke. The price of this handy device is 1s.
WHEN BUYING SILVER YOU LOOK FOR THE HALLMARK

WHEN BUYING A RECEIVER LOOK AT THE VALVEHOLDERS

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LOOK FOR THE
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PRACTICAL WIRELESS

September 22nd, 1934

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Chassis Modifications Wanted.

Sir,—I am very glad to know that you will be giving us a heterodyne set later on, for the congestion of the ether is such that it is impossible to get real selectivity on an ordinary set.—S. Grid, Det. and L.F.—and with the advent of the Droitwich transmitter matters are very much worse. May I venture a suggestion for the next set? The box chassis adopted in most of your sets is undoubtedly neat in appearance, but is that the most important thing to aim at? For an experimental owner it is a great nuisance to be obliged to reverse the whole set when a condenser, etc., has to be changed or a test made; and if this system is adopted might I suggest an alternative "above board" diagram be given for those who, like myself, prefer to "get at" the set with the least inconvenience. This arrangement has deferred a lot of us from trying out many of your new sets. Also, I hope the condenser dial with a 2 in aperture is a thing of the past and that full view scales will be adopted. In a set where direct off the mains, could an alternative be given for those having eliminating or batteries?—Oxo. W. Welch (Birmingham).

[What do other readers think regarding Mr. Welch’s suggestions?—Ed.]

A Querist’s Thanks.

Sir,—I thank you for your answer to my enquiry re excessive oscillation and beg to inform you that I found the by-pass condenser between screening grid and cathode of S.G. valve defective, just as you stated. Again thanking you for your assistance.—R. Patterson (Cheltenham).

A Friendly Gesture from America.

Sir,—In the July 14th issue of PRACTICAL WIRELESS you published a letter of mine concerning the reception of the "Phantom Strings" through WIXAL. I thought perhaps you would like to know of a very friendly gesture I received from America.

Following my reception report to the N.B.C. I received a letter from Mr. Aldo Ricci, who offered to play any request. Eventually I heard my request—and also my greetings from each of the "Phantom Strings" to myself. As a person with no position or importance, the gift of "Strings" to myself.

SIR,—Whilst the Editor does not hold himself responsible for what will be said to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, PRACTICAL WIRELESS, Estab’d 35 Years, 59* Rochester Row London S.W.1

Another Chassis Suggestion.

Sir,—While appreciating your efforts re stripped components as an aid and incentive to assistants in building efficient sets, there is one refinement which would be a great help which you might be able to effect. It is usual to build on either a metal or Metaplex chassis, and this seems to be likely to endure for a long time.

The provision of a Paxolin panel, say 10in. by 3in., about 3/8 in thick, would give a finish to either type of chassis. This might be engraved as follows:

A1 A2 E. Pick-up L S

and have a series of holes to take terminals underneath, as shown, plus smaller holes at the corners for the chassis, etc.

This is not so much a " wrinkle," as an idea that possibly you can find useful.—E. E. Wood (Russden).

An 8-valver for Overseas Use!

Sir,—It is a matter of disappointment to constructors out here that you do not offer sets with five or six valve requirements. For instance, it is no use buying a set in Capetown that has less than six valves unless one desires to listen in to broadcast stations only. What we desire is an 8-valve all-wave superhet, with all the latest improvements and working from 230 V.A.C. Do you think that you could include this in your programme for the near future?—H. Taylor (Capetown, S. Africa).

[We hope to consider the design of a suitable receiver for overseas use in the near future.—Ed.]

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W.B. "STENTORIAN" STANDARD model P929 5.00. For the "All-Pentode 3", mail to approved customers for 7 days’ trial for only 6/- deposit. If satisfied, pay further 3/6 od same, 6 monthly payments of 5/- (Cash, in 7 days, 40/-)

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E. T. HERAUD LTD

September 22nd 1934

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E. T. HERAUD LTD

September 22nd 1934
PRACTICAL LETTERS
(Continued from previous page)

Quality Reception
Sir,—I was rather interested to see the letter from Mr. Boyd of Harrow, and your reply. I rather doubt whether your reply is quite correct, as my own experience is that there are more people to-day who are in search of real quality and few stations than at any time since broadcasting commenced. It is, moreover, quite possible with tone control and var. selectivity to get enough foreign stations with a quality that is enjoyable. I made up sets for friends and not one had a quality which I would listen to.—A. B. (N.W.2).

“Alternative Connections”
Sir,—I have just read with interest the article on Alternative Connections, and feel sure some mistake has been made. Surely Fig. 2 shows the more practical method of connection, as this in effect is a decoupled circuit, and will allow any H.F. currents to be by-passed to filament. As a matter of fact, this is now the accepted way of using an output choke. In Fig. 1 the H.F. currents have to find their way back to filament through the resistance of the H.T. battery, and this is liable to cause instability if the H.T. battery is at all run down.

There is one point in using the arrangement shown in Fig. 1, and that is a smaller test voltage condenser can be used. Should this condenser break down, little damage will be done. In Fig. 2 a faulty condenser will pass full H.T. voltage to the filaments of the valves, if as in some cases L.T. positive is connected to H.T. negative.—H. V. Watling (Olchesteer).

[There was no mistake in the article and the method shown in Fig 1 is generally preferred.—Ed.]

An Exhibition Echo
Sir,—As a visitor to Radiolympia I saw plenty of woodwork and various tuning arrangements, but what about the hearing part of it? Loudspeakers working from the most perfect amplifier it was possible to have, under perfect conditions. All very nice, but how about those same speakers working behind their own particular circuit. Will they sound so perfect? I doubt it. If they are going to be exhibited let us also hear the whole machine, not one part of it. I know that is asking a lot, but it is not impossible.—A. Rogers (High Wycombe).

An Invaluable Handbook.

ACCUMULATORS
An up-to-date practical handbook dealing with every type of accumulator, methods of charging them at home, care and maintenance. Also explains how to erect a charging station.

This is one of NEWNES' HOME MECHANIC BOOKS

Ask your Newsagent to show you other Titles in this helpful Series.

Obtainable at all Booksellers, or by post 1/- each from George Newnes, Ltd., 6-11, Southampton Street, Strand, London, W.C.2.

USE THE CONDENSERS THAT EXPERTS USE

UNSCREW the back of this or that commercial set of another, turn to the specification of the 'star' receivers. Ask any serious experimenter or any expert dealer—Always T.C.C....

Make their choice your choice—use T.C.C. CONDENSERS.

ALL-BRITISH

There is a new illustrated price list—just ready. If you have not received a copy from your dealer a p.c. to us will bring you one.

THE TELEGRAPH CONDENSER CO. LTD., WALES FARM RD., N. ACTON, W.3
MAKING YOUR
SET ALL ELECTRIC!

To get the best possible results, you
MUST electrify your set. This
is simple and interesting. If you
have an elementary knowledge of the H.T.,
just scrap your battery valves, replace them with
A.C. valves, and incorporate a HEAYBERD
L.T. Transformer. Below are three popular models—

MODEL       OUTPUT       PRICE
229        2-2v., 3 amps.     15/-
731        2-2v., 10 amps.    25/-

Heayberd can supply a range of Complete
Transformers and Karadials fitted at
your own
FILL IN THE COUPON BELOW—

POST COUPON NOW—

F. C. HEAYBERD & CO.,
10, FINSBURY ST., LONDON, E.C.3

MODERN OF THE MAINS

PRACTICAL WIRELESS

September 22nd, 1934

RADIO CLUBS AND SOCIETIES

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

ANGLO-AMERICAN RADIO AND TELEVISION

T. H. West, Middleton and East Buckinghamshire
Branch of the Anglo-American Radio and Television
Society, will have a demonstration on Wednesday,
October 3rd at 8 p.m. All interested please write to Mr. L. L. King, "Dunbar," Willesden, London, W.11,
for particulars.

WILL it be shown that 1934 television demonstration
will be held at the City Hall, Wigan, whilst other
attempts have been suspended.

Mr. J. H. Secor, hon. sec., Southend Branch of
the Society, has written to all members, in an endeavour
to accommodate the Great Britain, between 5 p.m.
and 8.30 p.m. (British Summer Time) on September
the 14th, 22nd, and 29th.

He will transmit the following, in Morse code, for
the whole twenty minutes on each occasion:

INTERNATIONAL SHORT-WAVE CLUB

A VIBLY successful meeting of the London Chapter
was held on Friday, August 31st, and was
attended by over seventy short-wave listeners.
The meeting was addressed by Mr. A. K. Hear,
who spoke on " An Electromagnetic World.
He made it clear that short-wave listening was
really worth while, and outlined the technical
specifications of the radio, and the press to provide
more for the short-wave listener. In the past short-wave
listeners had been
poorly provided for.

On Saturday September 1st, the members of the
London Chapter visited the Battersea Power Station,
and heard a talk from the Engineer who is in charge.
A. D. Hear, Secretary, 10, St. Mary's Place,
Rochester, Kent.

SLIDE RADIO

A lecture at the meeting held last week was
given by Mr. J. H. Secor, who described the
new telling pointers.

The conclusion of the lecture was given, and this showed
That both members gave a fairly good pool of re-
production with ample volume, and the selectivity came
up to expectation. Earl. Dec, 116, Hillsway Road,
Gravely Hill, Birmingham.

CATALOGUES RECEIVED

To insure replies, trouble, we undertake to send on
at a discount 50p. of our advertisers. Merely state, on
a postcard, the name from whom you
require catalogues, and address it to "Catalogue"

For samples, see catalogues above. Our advertisers make no charge, or require payment. Undoubtedly, we
have to examine the by all correspondents. No
other correspondence whatever should be enclosed.

RICH & BUNDY

Listening to a point of studying quality
amplification will be very interested in the new
catalogues issued by Messrs. Rich & Bundy. This firm
specialises in the manufacture of transformers and
chokes and a special feature of its products is the
 provision of transformers designed for dual-phase output
circuit. The catalogue contains circuits of two typical
dual-phase amplifiers and in addition gives full
details concerning the system and other interesting
information regarding output transformers; mains
transformers, line transformers, etc.

PIFCO

A PAMPHLET has just been received from the
Pifco Co., in which the Rotameter, the Radiometer,
and the All-in-One meter are shown. The leaflet
also illustrates that these new instruments are provided
with a novel rotating scale fitted to the Rotameter, and
given full particulars concerning the use of the instruments.
A copy may be obtained on writing to the Provincial
and International Trading Co., Pifco House, High
Street, Manchester.

CELESTION

The new Celestion catalogue contains full details of
1 a complete range of Celestion speakers, which
include the 85 having an overall diameter of
5in., and the Audiolator, speaker, which
with an overall diameter of 24j in. is ideal
for all specialists in the field. When Mr. G. F. Fidde
will provide interesting reading, as it deals
with the developments that are affecting the
speaker. Celestion point out that only 500 of these
books were distributed at Radiolympic recently.

Soldered
contacts are better

ENGINERS ARE YOU EARNING LESS THAN £10 PER WEEK?

If so, you cannot afford to cash on without reading our
HANDBOOK. The book is a guide clearly and definitely
many earning a successful career. Among other things,
explains the Service of your own Departmental
office in the world of Engineering.

As the Editor of the BRITISH INSTITUTE OF ENGINEERS
PRACTICAL WIRELESS, 390, St. Pancras House, 39, Oxford
St., London, W.1.

FREE!

"I.R.T. THAT LASTS YEARS"

H. T. THAT LASTS YEARS

September 22nd, 1934

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contacts are better

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As the Editor of the BRITISH INSTITUTE OF ENGINEERS
PRACTICAL WIRELESS, 390, St. Pancras House, 39, Oxford
St., London, W.1.
The "Summit"

"I am anxious to build your set the "Summit," but have one drawback. At the moment I am using a three-valve set with — valves, and I was wondering would these valves come in useful for the set, to be used as V1, V2 and V3. I give here-with the characteristics of the valves in question." — J. H. (Blackburn).

As we have many times pointed out in these pages, we can only guarantee the receivers which we advertise when they are constructed exactly in accordance with the published specifications. The valves which you wish to use have almost similar characteristics, but the anode current of two of them is greater than the specified valves, consequently the H.T. applied to them is greater than the specified valves, and these are not so easily obtainable. The characteristics are generally the same, although there are several special American valves obtainable, of which there are no English equivalents. We do not know of a book of equivalent tables.

Local Disturbance

"I have constructed a two-valve receiver using an S.G. detector and pentode circuit. In the daytime this works splendidly, but at night I get a noise like a motor-cycle engine. How could you help me to rid my set of this?" — J. G. (Yeates).

As the set functions during the daylight it would appear that the circuit is O.K., but that when daylight ceases some form of electric sign is put into action nearby. This would give the trouble, and you should look round for a flashing sign or a powerful illuminating engine and you will no doubt find that your noises start when this is put into action. The remedy is in the hands of the owner of the sign, who should fit a suppressor. If you communicate with the postal authorities they will no doubt assist you if you cannot trace the interference to a definite sign.

The "Leader Three"

"I am going to build the 'Leader Three,' but have one drawback. At the moment I am using a two-valve receiver with the saving in current which is one with the certain knowledge that you which is used, etc. However, you can fit one with the certain knowledge that you will get the increased output given by the pentode with the saving in current which is given by the 'Leader Three.'

American Valve Types

"I notice that several manufacturers advertise American-type valves for sale in your columns. Are these valves suitable for the various types. If so, I should be greatly obliged if you will tell me how and where I can obtain it." — G. A. B. (Barnsley).

The valves are not interchangeable, owing to the fact that the valve pins are arranged in a different manner. Therefore, to use the American valves you would have to obtain special valve-holders, and these are not so easily obtainable. The characteristics are generally the same, although there are several special American valves obtainable, of which there are no English equivalents. We do not know of a book of equivalent tables.

H.T. Battery Troubles

"I have built an A.C. mains receiver, but wish to fit a fuse in it to avoid damage. Where is the best place to put the fuse so that ample protection is afforded?" — R. N. (Manchester).

The most suitable place for a fuse to protect from damage from the mains is between the mains leads and the primary of the mains transformer. To protect the transformer from damage due to a short on the receiver side, a fuse should be inserted in the H.T. negative lead, and should be joined immediately following the centre tap of the secondary winding. Alternatively, a fuse could be included in each anode lead of the rectifying valve if one is used.

H.T. Economisers

"I should like your opinion of the H.T. economisers using the Westector. I have only a two-valve set but would like to use a pentode in the output stage. At the moment I am afraid of the H.T. consumption, as I cannot afford too many H.T. batteries, but if the economiser works I should like to fit one." — A. J. B. (Stranraer).

The economiser does definitely function, although the exact economy which is effected obviously depends upon the total current taken by the receiver, the valve, which is used, etc. However, you can fit one with the certain knowledge that you will get the increased output given by the pentode with the saving in current which is given by the economising device.

September 22nd, 1934

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every enquiry and drawing which is sent must bear the name and address of the sender. Send your enquiries to the Editor, PRACTICAL WIRELESS, Gen. News. Ltd., 611, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE

We wish to draw the reader's attention to the fact that the service is intended for the solution of problems or difficulties arising from the construction of receivers described in our pages, or on general wireless matters. Questions are answered, for obvious reasons:

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our columns.
(3) Supply circuit diagrams of complete multi-valve receivers.
(4) Answer queries over the telephone.

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SPECIAL OFFER B.T.H. Gramophone Motors, A.C. and D.C. 100/200v., 35/-.

ELIBON Dual Magnet Motor for Radios with mains transformer, complete with turntable and all fittings, a really sound job, 25/- each.

SPECIAL OFFER of Wire Wound Resistances, 4 watts, 350 ohms, any values to 2,000 ohms, any wattage up to 50,000 ohms, 45/- each.

WHEN Wound Potentiometers, 15,000 ohms, 50,- 50,000 ohms, 5/-; 500,000 ohms, 5/-; 1,000 ohms wound semi-shunted, 5/-; 10,000 ohms semi-shunted, 10/-.1 os, 15/-.10, 20/-.

CENTRALBULB Potentiometers, 400 ohms 1/5, 100 ohms, 2/5, 1000 ohms, 5/-. 1,000 ohms, 10/-.

POLAR Star, manufacturers' radios, 3-cong. ga1 attainers, fully screened, 7/-; with trimmers.

AMERICAN Single & Double 0.0005 Condensers, for trimmers, 4/-; 10, 15/-. 2/-; 20, 30/-.

F.L. High Voltage Coils with Circuit, accurately matched, dual range, 3/- per coil; diode, ironcased, 3/-.10.

RELIABLE Type 4400, Electrolytic Condensers, 550v. working, 1 mf., 1/-; 2 mf., 2/-. 5/-.5; 10, 15/-.6.

R E R I B O N 4 mf. Electrolytic Condensers, 455v. working, 1/-.

POLAR 3-pkg. Unkond Condenser with trimmers and mains transformer, complete with instructions, 5/-.10.

WESTERN ELECTRIC Condensers, 250v. working, 1/-.

C.C.C. Electrolytic Condensers, 650v. working, 500, 4/-; 500, 6/-; 500, 8/-; 500, 10/-; 1,000, 15/-; 2,000, 20/-.

TOP, 500, 7/-. 500, 9/-; 500, 10/-; 500, 12/-; 500, 15/-; 1,000, 25/-; 1,000, 30/-; 1,000, 35/-;

POULSEN Condensers, 2,500v. 100, 6/-. 100, 8/-; 100, 10/-; 100, 12/-; 100, 15/-; 200, 20/-; 200, 25/-.

THE Following valve battery has been added.

1 x C.T. L.T. Charger, 8/-
4 x 100 ma., 15/-
2 x 200 ma., 25/-
2 x 300 ma., 35/-
1 x 500 ma., 55/-
1 x 1,000 ma., 10/-. 2/-.5

SMALL LOTSON 3-gang 0.0005, 12/6, 12/-.5.

IGRANIC Superhet Coils, set of 4 (1 Osc., 2 I.F., with trimmers), 30/-. 30/-.5.

POLAR 3-pkg. Unkond Condenser with trimmers and mains transformer, complete with instructions, 5/-.10.

WHEN Wound Potentiometers, 15,000 ohms, 50,- 50,000 ohms, 5/-; 500,000 ohms, 5/-; 1,000 ohms wound semi-shunted, 5/-; 10,000 ohms semi-shunted, 10/-.1 os, 15/-.10, 20/-.

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POULSEN Condensers, 2,500v. 100, 6/-. 100, 8/-; 100, 10/-; 100, 12/-; 100, 15/-; 200, 20/-; 200, 25/-.
SEPTMBE R BARGAINS
At the "GOLD-MINE" STORES, of London.

Listed supplementary to the September "RADIO GOLD-MINE" now available. Enclose 3d. stamp for details.

27/6 CLASS A.C. ELIMINATOR KITS with 2,500 ohm. £1.9.11.11. CL.B. 111 SEALED KITS. An unprecedented bargain at 9d.

18/6 S.G. III KITS. Complete in sealed cartons.

17/6 A.C. ELIMINATOR KITS, 25 ma. State voltage.

14/6 ORMOND PERMANENT-MAGNET, P.M. ELECTROMOTORS (2 ft. 2 in.Ø).

12/6 SHOP MODEL-P.K.V. KITS. Will tune in the world.

10/6 B.C. CONVERSION KITS. Complete

10/6 S.G. III KITS. In sealed cartons, with full instructions.

SAMPLE BARGAIN COMPONENTS PARCEL. Guaranteed values, 39/- to 46/-.

9/6 WESTINGHOUSE 4/11 WESTINGHOUSE H.T.5 rectifiers.

6/- STEEL& CHROMIUM 11 ft. 6 in. GIN.

4/-1/11 an 18 in. CLASS B A.C. ELIMINATOR KITS with GOLD-MINE, now available.

Listed supplementary to the September "RADIO GOLD-MINE." By far the most comprehensive selection of components and accessories since launched.

Your Copy of the Sept. 'RADIO GOLD-MINE' to-day.

PRACTICAL WIRELESS

THE PERFECT COMPACT AERIAL PLUS.

The DYTAN is now more than an indoor aerial. It is a unique little unit for your radio and enables you to enjoy excellent reception with pure base and selectivity. Design is in the nature of a transistorised aerial from listening to the short waves. It is perfectly wireless, and can be connected to the aerial terminal of your set. Ideal for H.F. receivers. Send 3d. for extra post pack and set it up in your room.

What Expert says about the DYTAN:

"...an aerial of great sensitivity and range from indoors..."

West of London.

WILLIAM T. TURNER, "Faanfield" Radio Shop, Horsham, Sussex.

To complete, satisfaction or money back.

By E. M. BERRIMAN (Dept. 6,

"THE GOLD-MINE" STORES.

At the "GOLD-MINE" STORES, of London.

THE GOLD-MINE STORES,

7 Broadway, Ludgate Hill, London, E.C.4

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To complete, satisfaction or money back.
ON TOP AT THE SHOWS

Osram Valves

Made in England
Sold by all Wireless Dealers.

Olympia

Glasgow

and now Manchester

Stand No. 23-26

If you are unable to visit the G.E.C. stand write for the OSRAM VALVE GUIDE (1934/35) Edition. Sent post-free.

Osram Valves are now obtainable from 5/6 each