

OBTAINING QUALITY REPRODUCTION

Practical and Amateur Wireless

3^D
EVERY
WEDNESDAY

Edited by F.J. CAMM

a GEORGE
NEWNES
Publication

Vol. 8. No. 186.
April 11th, 1936.

AND PRACTICAL TELEVISION

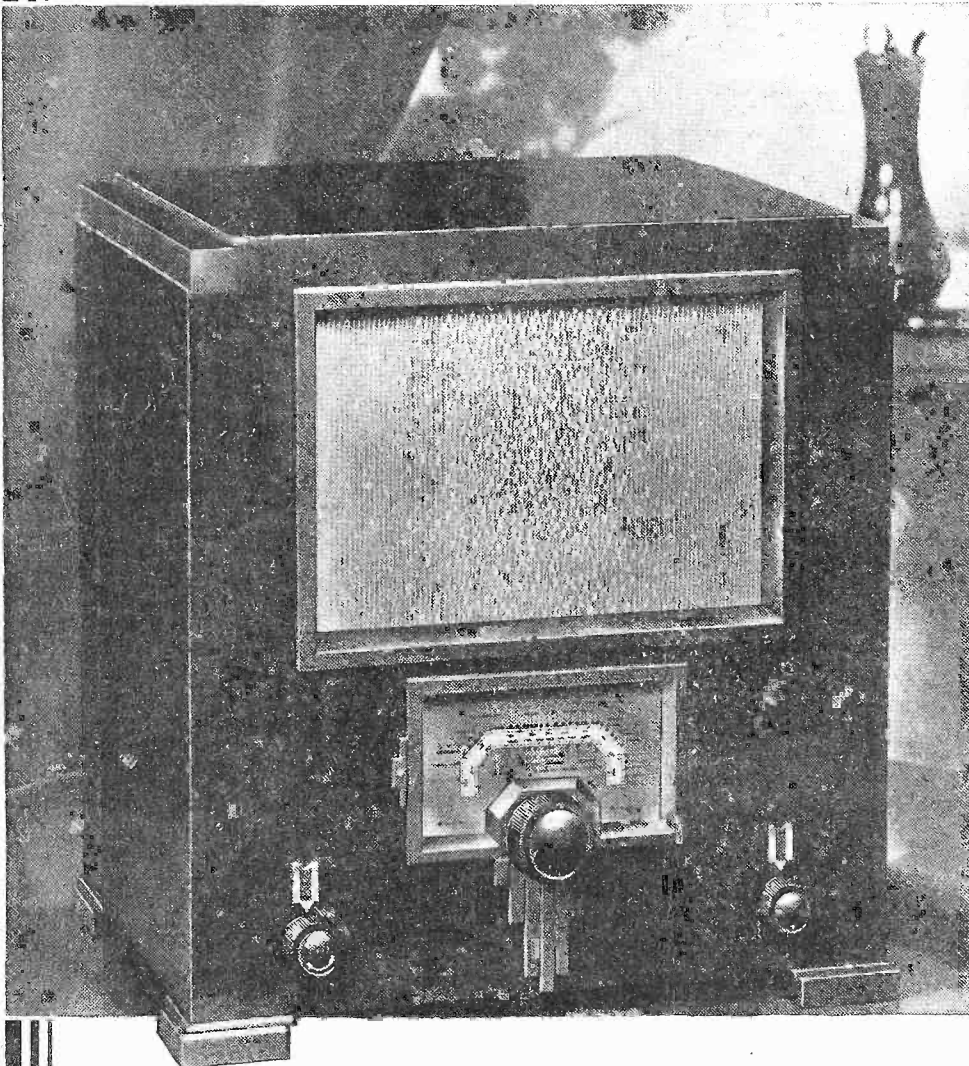
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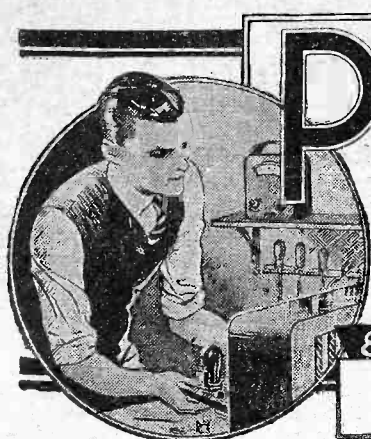
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CHEMISTRY IN RADIO *See page 101.*



Practical and Amateur Wireless

Edited by F. J. CAMM

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

VOL. VIII. No. 186. April 11th, 1936.

ROUND *the* WORLD of WIRELESS

Hungary's Relays

WHEREAS the broadcasts from Budapest (594.5 m., 546 kc/s) are frequently marred by morse interference, it is often possible to secure a clear reception of the same programme through Miskolc on 208.6 metres (1,438 kc/s). The transmitter is only rated at 1.25 kilowatts, but in that portion of the band provides a powerful signal. Occasionally on 267.4 metres (1,112 kc/s), Nyiregyhaza, relaying the capital, may give a good signal, but only in the later hours of the evening when Alexandria, sharing the same channel, has closed down.

Proposed 100-kilowatt for Lithuania

THE Lithuanian Government has voted the sum necessary for the construction of a 100-kilowatt transmitter to replace the present 7-kilowatt station at Kaunas, operating on 1,935 metres (155 kc/s). Work on the construction of the buildings will start this year. It is also proposed to instal short-wave plant for the relay of the programmes to overseas listeners.

A Bid for Supremacy

FROM Paris comes the news that the proposed Poste Nationale (150 kilowatts) is to be situated at the village of Allovis, between Bourges and Vierzon. It is reported that twin 150-kilowatt transmitters are to be installed, and will be constructed in such a manner that 300-kilowatt power may be obtained. The station will work on the channel now used by Radio-Paris, namely, 1,649.7 metres (182 kc/s), and should be ready by the end of 1937.

New Paris Broadcasting House

THE French Ministry of Posts and Telegraphs has allocated the sum of ten million francs for the construction of central broadcasting headquarters in the capital. The actual amount to be spent on its equipment and decoration will by far exceed the credit, but it is said that the balance will be borne by the organisers of the 1937 Paris International Exhibition.

Denmark's Proposed Short-Wave Broadcaster

TO provide a service for their shipping in all parts of the world, the Danes propose to build a powerful short-wave

broadcasting station which would not only supply daily news bulletins, but also a relay of the Copenhagen programmes.

Reduced to its Simplest Expression

IN future, the Kalundborg and Copenhagen stations will shorten the call of *Kjbenhavn, Kalundborg og Danmarks Kortbolgesender* to two words, namely: *Danmarks Radio*. The interval signal is to be retained.

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Imminent Opening of Radio Marconi

WORK on the high-power station at Bologna (Italy) has progressed so satisfactorily that it is expected the official ceremony of its inauguration may take place on April 21st next.

Remarkable Short-wave Broadcast

BY means of a new magnetron transmitter, the Philips works at Eindhoven (Holland) have succeeded in transmitting signals on an ultra-short-wave channel of 1.20 metres to a distance of roughly forty miles. The aerials of the transmitting and receiving stations were respectively 264 and 303ft. high.

Weather Reports and Forecasts

IN view of the rapid development of aviation services, and greatly increased activity, the Air Ministry has extended its

daily schedule of weather reports and forecasts. They are now broadcast from Borough Hill (Northants) on 1,186 metres (253 kc/s) at the following times: G.M.T. 06.45 (Summer only; not Sundays); 07.15, 07.30, 08.00 (Summer only); 08.15, 08.45, 09.00, 09.15, 10.15, 10.30, 11.15, 11.45, 12.15, 13.15, 13.30, 14.15, 14.45, 15.15, 15.45, 16.15, 16.30, 17.15, 18.15, 18.30, 19.15, 19.45. As these reports cover the greater part of the British Isles, they are proving of considerable interest to the ordinary listener.

U.S.A. High Fidelity Station

W²XR is the call sign of a transmitter working at Long Island City (New Jersey) on 193 metres (1,550 kc/s). High-fidelity broadcasts are made daily from G.M.T. 22.00-01.00. In view of a recent poll taken from the radio audience, the schedule will shortly be extended until 03.00.

Broadcasts from Newfoundland

ALTHOUGH only rated at 500 watts transmissions from VONF, St. John's, Newfoundland, on 251 metres (1,195 kc/s), and operated by the Dominion Broadcasting Company, Limited, have been heard in the United Kingdom.

Radio in the Pacific

A WIRELESS station is to be installed on the Phoenix Islands, situated on the Suva-Honolulu steamship route, and lying some 600 miles to the North of the Fiji Isles. Although practically deserted, the islands will be the base of a scientific expedition, composed of astronomers, to view the total solar eclipse which is taking place in 1937.

In Close Touch with Europe

THE average radio fan in the United States hears much of the European radio programmes in the course of a year. During 1935, the National Broadcasting Company relayed 229 broadcasts, and the Columbia System provided as many as 149 foreign transmissions to its listeners.

An Income to Play With

THE gross revenue of the National Broadcasting Company of America for the year 1935 amounted to \$31,148,931, or roughly £6,230,000. Figures for the Columbia Broadcasting System for the same period have not yet been officially published.

ROUND the WORLD of WIRELESS (Contd.)

Parsifal Concert

AS in former years, a special concert will be given on Good Friday, April 10th, in the Queen's Hall, at 7.30 p.m. Sir Henry Wood will conduct and the programme will consist of excerpts from "Parsifal." The "Prelude," and the Grail scene and Finale from Act 1 will make up the first part of the programme (7.30 to 8.30 p.m.), while Part 2 (from 8.45 to 10.20 p.m.) will consist of the following scenes: Act 2—Klingsor's

INTERESTING and TOPICAL PARAGRAPHS

Easter Concert Parties

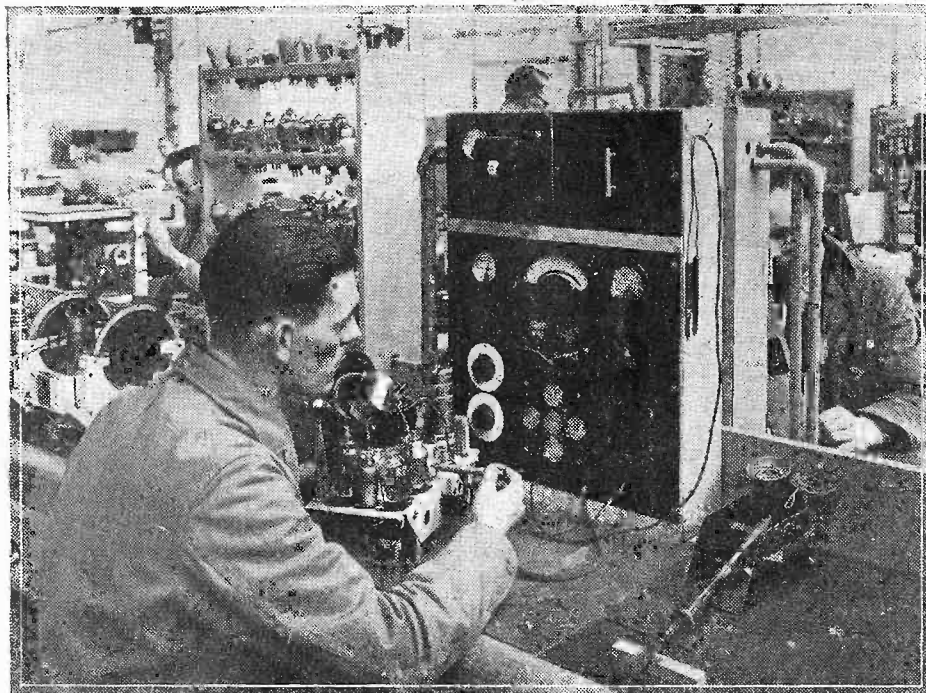
TWO well-known Northern concert parties, which have been on tour during the winter, return to their summer headquarters for Easter week, and they will broadcast to Northern listeners on April

The party includes comedians, entertainers, singers, a ventriloquist, soubrettes and dancers, and the famous beauty chorus, Madame Helena Lehmiski's Young Ladies. Mr. Terry himself is the compère.

"Week-end out of Doors"

NOW that April's here the Talks Department of the B.B.C. begins to put into effect the plans which have been simmering for months for the proper entertainment and recreation of its listeners in spring and summer. The first of these, to be given in the Scottish programme on April 10th, is "Week-end out of Doors," which is a weekly bulletin of advance information on walking, climbing, sailing, and angling, together with local weather forecasts affecting these activities. The bulletin will be edited by Ian Wilson, a Glasgow journalist, and its scope will cover Scotland at least from Spey-side to Galloway. The Scottish Youth Hostels Association are co-operating in supplying information for walkers and climbers, and the bulletins should prove very useful to those who are planning holidays of a week-end or longer.

NEW EKCO SERVICE CENTRE



A corner in the new Ekco Service Centre, showing the test bench equipment for testing and repairing sets returned for servicing.

Magic Garden, the Flower Maidens, and the scene between Kundry, Parsifal, and Klingsor; Act 3—the Good Friday Music, the Prayer of Amfortas, the Procession of Knights, the Healing of Amfortas, and the closing scene. The B.B.C. Symphony Orchestra and the Philharmonic Choir, augmented by a contingent of boys from the London College of Choristers, will take part; and the soloists will be as follows: Muriel Brunskill, Walter Widdop, Herbert Heyner, Norman Walker, Victor Harding, Elena Danieli, Kate Winter, Janet Powell, Helena Bromley, Molly de Gunst, and Myra Owen.

The Two Easters

CHENRY WARREN, who broadcasts fortnightly talks on the Midland countryside, has devised for April 12th a mosaic programme of poetry and music on the theme of the Two Easters—the Easter of the Christian Church and the Easter of Nature. This is not his first experience with this kind of programme, for he previously devised a mosaic on "Men and the Machine."

"Western Week-end"

THE first of a series of programmes from different places of entertainment in the Region will be given on April 11th under the title "Western Week-end." This series is a development from the early series "You Pays Your Money." A broadcast will be taken from the Headland Hotel, Newquay, from an Organ Recital by Reginald Porter-Brown at Torquay, and from a popular orchestra.

14th. They are the Arcadian Follies from the South Pier, Blackpool, and the "Bouquets," who are to broadcast from the Floral Pavilion, New Brighton.

Gypsy Music from Harrogate

YASCHA KREIN and his Gypsy Orchestra, who are to broadcast from the Valley Gardens, Harrogate, on April 10th, will contribute another programme on April 12th. A native of Russia, Yascha Krein studied music at the Imperial Conservatoire in Petrograd. Coming to England, he joined the old Queen's Hall Orchestra under Sir Henry Wood. He resigned in order to become leader of a Viennese Orchestra in Scotland. His present combination was formed three years ago.

A "Sports Causerie"

A "SPORTS Causerie" will be broadcast from Cardiff on April 14th, in which C. B. Thomas, Muriel Orsman, B. Watts Jones, and W. Rowe Harding will review the winter's activities in Wales in boxing, hockey, soccer and rugby.

Pleasure on Parade

FRANK A. TERRY'S touring concert party, "Pleasure on Parade," will be in Doncaster on April 9th, and it is at the Grand Theatre there that the Northern microphone will track them down in the evening. Presented under the heading "Northern Concert Party on Tour," excerpts from their show will be broadcast.

Concert from Torquay

ORIS COWEN (contralto) will be the artist in a concert by the Torquay Municipal Orchestra, conducted by Ernest W. Goss, to be broadcast from the Pavilion, Torquay, on April 14th.

Eugene and his Magyar Quartet

THIS combination appeared at the Royal Command Performance in 1932. It has been broadcast on three occasions from exhibitions in the Midlands where it has been appearing, but April 13th will be its first Midland studio broadcast. Eugene has toured in many parts of the world. At the age of fifteen he was playing in a café in Buenos Aires. The combination is having a season at Prince's Café, Birmingham. The vocalist is James Benbridge, who was formerly with the Gresham Singers.

SOLVE THIS!

PROBLEM No. 186.

Johnson built a superhet using reliable components with matched coils and gang condenser. Reception was moderately good, but if the gang condenser trimmers were adjusted so that stations tuned in at the correct wavelength setting at approximately 250 metres, they were about 15 metres out at 500 metres, and vice versa. What was the trouble? Three books will be awarded for the first three correct solutions opened. Address your letters to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2. Envelopes must be marked Problem No. 186 in the left-hand corner, and must be posted to reach this office not later than the first post Tuesday, April 14th, 1936.

Solution to Problem No. 185.

Hollis had overlooked the fact that a large voltage drop occurred across the field winding of the energised speaker, thus reducing the valve anode voltages to too low a value.

The following three readers successfully solved Problem No. 184, and books are accordingly being forwarded to them: N. K. Batchelor, 106, Evenlode Crescent, Coventry, Warks.; R. C. Tyler, 48, Burlington Gdns., Chadwell Heath, Essex; J. Robertson, Aukengill, Wick, Cathness.

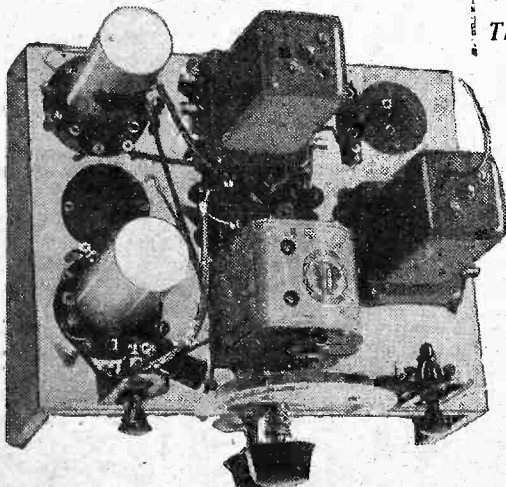
Obtaining Quality Reproduction

In This Article some of the Methods Adopted by Set Manufacturers for Obtaining Quality Reproduction are Discussed

ON many occasions, articles in these columns have stressed the suggestion that the development of high-quality reproduction provided a field for experiment which is particularly suited to the radio amateur. It was also stated that in general, the amateur had a better chance of making a good high-fidelity set than the ordinary listener had of buying one, since the almost universal cry from the man in the street was for sets sufficiently sensitive and selective to give him large numbers of stations, almost irrespective of the quality of reproduction. Finally, it was suggested that the time would come when the commercial set manufacturer would find it necessary to pay more attention to fidelity of reproduction, and to put on the market at least a proportion of models having some claim to realism of tonality.

While we lay no claim to the gift of prophecy, and are quite content to suggest that our previous articles were based upon pure reasoning, we cannot refrain from pointing out that the state of affairs which we then forecast has now come about. A very large proportion of the principal manufacturers are now advertising receiver models which are described as "fidelity" sets, and, from our own observation, these quality models do represent a very substantial advance in reproduction. Not only so, but the general standard of quality in all reputable makes has very definitely advanced.

It may be said at the outset that this article will exclude all those luxurious fidelity sets which are sold at prices between 30 and 150 guineas, because they are quite beyond the reach of the average listener and, moreover, are usually attempts to combine high performance by way of the number of stations receivable with naturalistic reproduction, and include gramophone equipment with auto record changing



Another quality receiver, Mr. E. J. Camm's two-valve superhet.

and most elaborate and expensive cabinet work. We will confine our remarks to ordinary table models costing, at the most, 20 guineas, and it must be remembered that even at that price, which includes cabinet work, cost of assembly and advertising charges, the design must be such that the intelligent constructor should be able to produce as good at lower cost.

The Superhet

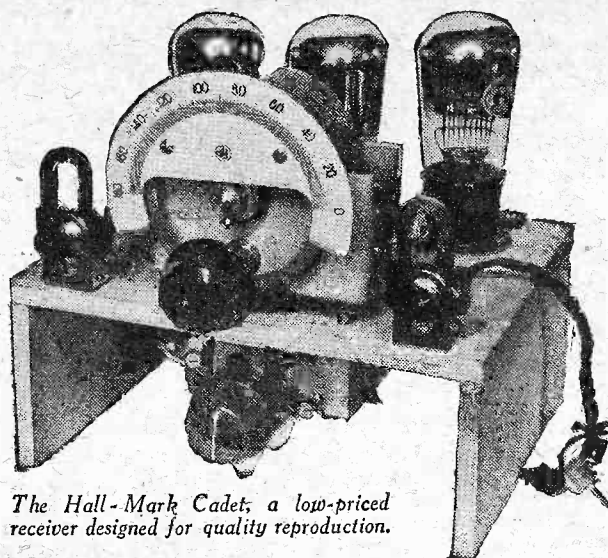
There has been a general impression that really high quality reproduction cannot be obtained in a superhet, and it therefore may come as something of a shock to find that quite a number, in fact the majority, of sets advertised as of the high-



The popular Stentorian speaker, designed for use with any receiver to obtain correct matching.

fidelity type, come under the superhet class. It will, therefore, be necessary to describe both straight and superhet sets in the quality range.

Analysis of a large number of commercial sets brings out one point which is common to practically all makes, and that is that set makers as a whole have realised what we have pointed out on so many occasions, namely that the loud-speaker is still by far the weakest chain in the link. It is simply useless, and a waste of time and money, to provide circuits of wide frequency response, to design receivers with nicely adjusted values and automatic devices for avoiding overloading, and to fit last stage valves giving a large output of undistorted power, if the speaker cannot reproduce the



The Hall-Mark Cadet, a low-priced receiver designed for quality reproduction.

extreme top and bottom frequencies, or if it produces a crop of resonances at all sorts of places in the musical scale. There was a time, and that not so very long ago, when the speakers commonly fitted in commercial sets were tiny little units of poor performance, which could be made at the cost of only a very few shillings apiece. To-day, any set put forward as a quality receiver, will be found to contain a speaker of generous design and having a really good performance characteristic. For the sake of cheapness, energised models are chiefly used in mains sets, but with the latest improvements in special magnet alloys, the permanent magnet models are of almost identical performance.

The Choice of Speaker

The lesson which the constructor must learn from the set maker in this connection, therefore, is to start designing his quality set from the output end. Obtain the best speaker you can afford, and design your set around it. A speaker of this year's design, costing in chassis form from 1½ to 2 guineas, may be taken as fully equivalent in performance to the speakers employed in the average commercial fidelity table model, so that the constructor is at no disadvantage on the score of the speaker.

Working back from the speaker towards the aerial, we next come to the output stage. Two factors have to be considered here, the actual power output in milliwatts, and the class of valve, namely triode or pentode and, in the case of battery sets, whether Class "A," Class "B," or Q.P.P. working.

With regard to total output, a last stage capable of a big undistorted output is advisable so that even on the loudest passages there will be no distortion. Bearing in mind that 50 milliwatts represents the minimum for reasonable volume for quiet passages, a 2½-watt output valve gives a factor of safety which is adequate where only moderate volume is required, but a 5-watt output stage is generally considered the minimum for serious high-fidelity work. There are, however, very few commercial sets at prices up to 20 guineas giving more than 3 to 3½ watts undistorted output, and practical tests show that while such sets do give really good reproduction so long as volume is kept within reasonable limits, there is a tendency to overload if the volume control is advanced too far. We, therefore, repeat our own conviction that the constructor desiring quality must exercise his discretion in handling the volume control if he confines himself to a 2½ to 3 watt output stage,

and that he will be well advised to go one better than the commercial makers and fit at least a 5-watt valve.

While there is little question that a triode output stage has the best possibilities with respect to tonal fidelity, and is also less easily overloaded, quite a large number of commercial fidelity sets use pentodes. The rather greater sensitivity of this type permits some saving in cost, and manufacturers have succumbed to the temptation. The pentode has a further allure in this connection, since the higher top-note response of this type of valve compensates in part for the attenuation of upper frequencies brought about by the sharpness of the tuning.

Comparisons

This brings us to the fundamental difference between the average commercial fidelity set and the average amateur fidelity set. The former is an attempt to combine a better standard of quality with a degree of selectivity which will still give a very large selection of stations, while the quality enthusiast who builds his own set is usually perfectly willing to sacrifice stations for still better reproduction. As a result, the commercial quality set is usually crammed with tone compensating devices calculated to provide a final output containing a reasonably balanced quality but not necessarily a faithful replica of the original performance. The net result is certainly pleasing, and satisfies a very large proportion of listeners, but it lacks the individuality and naturalness which can undoubtedly be obtained in a simpler and far less expensive way if only the desire for wide-world listening can be put aside. Again we say, stick to the triode—a good hefty fellow—or, better still, two in push-

pull, and avoid as far as possible all tone correction circuits.

In practically every commercial fidelity set the speech detector is a diode, and here we are in thorough agreement with the set maker. Usually there is no other L.F. amplification between the diode and the output stage, but in some instances a double-diode-triode combination is employed. It is probable that the degree of amplification obtained in the L.F. stage is obtained a little more cheaply than is possible in the pre-detector stages, but even so, for the amateur builder, an additional L.F. stage is not a very good proposition, as it is easily the most prone to introduce hum, and calls for great care in both design and layout. Get all your voltage amplification in the high-frequency stages is a good motto for the home constructor.

The H.F. Stage

There is little to be said about the high-frequency side of those commercial receivers using a straight circuit. In most cases the aerial input is of the band-pass filter type and the inter-valve couplings high-frequency transformers of conventional type. The superhets, on the other hand, have interesting features. The aerial input circuit is again of the band-pass type, but the intermediate-frequency transformers—which are, in effect, additional band-pass filters—are so designed that the width of the band accepted is variable. This variable selectivity, as it is termed, is achieved by adjusting the coupling between the two windings, either by variation of the value of one of the coupling components or by adjusting the position of one of the coils with respect to the other. By these means the set can be used as a conventional highly selective superhet for "all stations"

listening, or, with the band width increased to maximum, as a less selective set for quality reproduction.

The snag in this arrangement is, of course, that as soon as the selectivity is reduced for quality reception, in come the interfering stations—a difficulty also experienced by constructors who interest themselves with fidelity reproduction. As a result, the commercial quality sets are for the most part so designed that even at minimum selectivity there is a considerable degree of high-note attenuation, which accounts, no doubt, for the readiness with which tone compensating devices and similar aids to synthetic "quality" have been adopted.

While, therefore, set makers must be given due credit for their efforts to improve the general standard of reproduction, and while it must be admitted they have been successful up to a point, it must not be imagined that the fidelity problem has been brought very much closer to solution. The whole problem simply bristles with difficulties, most of which are, so far, not within either the manufacturer's or the listener's control, being due to the existence of far too many stations. At the best, a quality set must be a compromise between conflicting conditions. The commercial solution is synthesis—the building up of pleasant quality without too much heed to fidelity of reproduction of the original. This is perhaps unavoidable, since the commercial set must be capable of satisfactory operation under all conditions, anywhere. But the home constructor, who has only to cater for his own personal and local conditions, can often achieve far better results, more cheaply, and without too many correcting and compensating circuits. H.C.

Canoe Cruise on the Avon

THE British Canoe Association hold their annual cruise on the Avon, the stretch for Easter Monday being from Warwick Castle to Tewkesbury. About forty canoes (mostly collapsible) will be taking part, carrying in all about seventy members. On April 13, Hans Renold, leader of the meet, will describe from the Midland Regional the day's cruise in an eyewitness account just after the Second News.

Service from St. Martin's

ON Easter Sunday, evening service will be heard from St. Martin-in-the-Fields, when the sermon will be given by the Rev. H. R. L. Sheppard, Canon of St. Paul's. Later in the day a short biblical drama by Mona Swann, author of "Mary the Mother" and "The Prince of Peace," will be produced by Robin Whitworth. This play, in which music and speech are particularly happily blended, was first broadcast on Easter Day last year. The players will include Ion Swinley, Christopher Casson, John Garside, and Lillian Harrison.

Shakespeare Festival

ON April 14th First Night Impressions of the Shakespeare Festival at Stratford-on-Avon, which is to begin on Easter Monday, will be given by M. F. Fraser, News Editor of a Birmingham newspaper, who has attended most of the Festivals in the past twelve or fifteen years. This year the Company's season will be a fortnight longer than last year. B. Iden Payne directs the Company. The play for the Birthday (April 23rd) will be "Much Ado about Nothing." The unfamiliar Shakespeare play to be included this season is

EASTER PROGRAMMES

"Troilus and Cressida." The accommodation in the gallery of the Memorial Theatre at Stratford-on-Avon has now been extended.

"Quayside Nights"

THE fifth edition of "Quayside Nights" will be broadcast from Brixham on April 14th. Walter Barnes, a fisherman, will recite what is known as "The Fisherman's Alphabet," originally written for the Fishing Exhibition; Jabez Lake, known as the Fisherman Poet of Brixham, will read one of his own poems and will also sing fisherman songs; Charlie Howe will give an account of the Brixham Trawler Regatta; and some young folk from the Seaman's Orphanage will sing sea-shanties and swing Indian clubs at the same time. Brixham was the home of the composer of "Abide With Me," and this famous hymn-tune will be played on the bells of Brixham Church.

Leicester Dog Show

ANOTABLE Easter Tuesday event in the East Midlands is the annual show, of the Leicester Canine Society. The judging is completed early in the day, and in order to give a microphone impression of the Show at suitable times for listeners, recordings will be made. There will be descriptions of preparing dogs for the Show, preparing the Show for the dogs, and the methods of judging, and, in order to get good

background noises, there will be a microphone on the terrier benches. The recordings taken at the Granby Halls, Leicester, where the Show is held, will be heard in the Children's Hour on April 14th, and again in the evening programme.

Cabaret from Northern Ireland

LISTENERS who like broadcasts from roadhouses will be interested to hear that another fifteen minutes' broadcast has been arranged from the Heart o' Down Roadhouse, Ballynahinch, on April 13th. The Heart o' Down Roadhouse is now almost as popular among listeners as it is among its patrons.

"An Ambiguous Escape"

IF you were motoring over moors on a dark winter's night and came across an escaped convict, whose story convinced you of his innocence and made you believe in his wrongful imprisonment, what would you do? That is the problem which faces a retired judge in F. M. Cornford's radio play, "An Ambiguous Escape" to be broadcast on April 14th in the Northern Ireland programme. How Sir Robert, the retired judge, a man he encounters on the moors, a station-master and a prison warden find themselves gathered together in the restaurant of Longmoor Railway Station, holding an unofficial inquiry which becomes a discussion on logic and the identity of indiscernibles, is told in this amusing and exciting play. But there is a remarkable and unexpected twist at the end, and beneath all its humour there is an undercurrent of philosophy. S. A. Bulloch, who produced the play in the National programme some time ago, is to produce it again on April 14th.

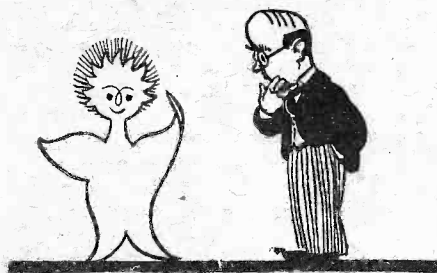
On Your Wavelength

Family Names

IT seems that I must make clear to some of my readers the relation which exists between me and a well-known figure which appears almost every day in the daily newspaper and which also may be seen sometimes on some of London's omnibuses. I am prompted to make this statement due to the fact that some of the letters which are now reaching me are being addressed to Mr. Therm, or the writers open their letters with the greeting, "Dear Mr. Therm." Now I am no relation and have no kinship with the delightful little man who bears the name of Therm, although he may be as hot as I in some respects. His father was one Thermos, a Greek, but I cannot lay claim to such noble parentage. However, I should be glad if you would note that I am Thermion, and whilst I appreciate the friendliness which is shown by the familiarity of the greeting, I do not wish to be confused with Mr. Therm. Other papers please copy!

A New Use

I HAVE just heard of a new use for the radio, and in view of the hundreds of henpecked husbands who have to sit and listen to the wagging of wives' tongues, I must pass on this hint, although it is probable that it will already have been discovered by many. Incidentally I was informed of it by a friend who suffers from the above malady, and he says that he used to find the evenings terribly boring whilst he heard how Mrs. So-and-So had just bought a new hat and other items of local scandal, but he has now built a 6-watt radiogram and he finds that he can now sit down in comfort, with his pipe and



I am no relation to Mr. Therm.

a paper, and can rest in peace without hearing his wife's tongue. I did not go into the matter deeply in order to find out how he can find peace with 6 watts blaring out at him, but I presume that it is a case of the lesser of two evils and that this cacophony is preferable to the old wives' tales. At any rate, I sympathise with him from all angles.

Go-ahead Football

I SEE that the Arsenal Football Club are having a new grandstand built at a cost of £100,000, and that the stand is to contain a special room wired for television reception and transmission. This is good news and will, I am sure, be of interest to all my readers, who must envisage the time when all of our sports are televised so that

By Thermion

we can view them in the comfort of our own homes. I was very glad to see in this connection that the manager of the Arsenal team does not anticipate any loss in the gate due to television, and that he hopes that the first team home matches will be televised when the new station is completed. What wonderful possibilities are to be opened up to us when the television receiver becomes part of our normal wireless equipment. There are, of course, still many obstacles to be overcome, but the fact that the Arsenal team are making preparations for this branch of the science shows that there must be an increasing public interest in it, and we trust that their efforts will be rewarded by apparatus which will enable the whole of the game to be seen, and not simply a goal-mouth view.

What Next?

A FRIEND who is on one of the dailies told me of some of the peculiar communications they receive from time to time and of some of the events which liven up their usual routine. But I think one of the prize ones was about a lady who rang up the editor to complain that the B.B.C. announcer who was reading out the news bulletin was chewing a sweet. She was asked how she knew this and she said that it was obvious as her radio was perfect and she could detect the slightest thing, and that she was disgusted to think that an announcer should speak with his mouth full. After carrying on at some length the editor told her that he could do nothing, and that she ought to ring up the B.B.C. "But I can't do that," she exclaimed. The Editor asked her why not, as they were the correct people to whom complaints should be made. Her reply laid the Editor out for the rest of the night, for she calmly said: "I can't get on to them because I haven't paid my licence this year." Now can you beat that?

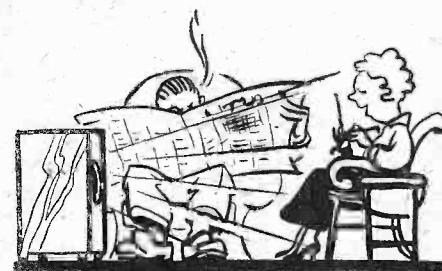
Trouble Tracking

I KNOW that many readers are interested in problems which arise in various receivers and in the methods of locating trouble, and therefore the following details will no doubt be appreciated, although I should like to state, before going any farther, that I cannot explain the matter satisfactorily. The set was a simple two-valve all-mains outfit, operated from A.C. supplies, and utilising a high-efficiency detector followed by a pentode. The trouble was that at odd intervals a terrible crackling noise would set up and it was found by the user that by stamping on the floor the noise could sometimes be stopped. Obviously, you will say, there was a loose connection; but read on. After some weeks it was suddenly noticed that when certain of the house electric-light switches were operated the noise would start and in some cases the volume would fall to less than

half. A technical man was called in and he replaced the earth connection, replaced the valves and examined every joint (soldering had been adopted) and could find no fault at all. Still the trouble persisted. You would never dream what was found eventually to be the cause, and probably it would not happen again once in a million times. The set was tuned by a two-gang condenser of a well-known make in which a bakelite dielectric was employed and the two condensers were controlled by a single spindle. This was hollow, and running through it was another spindle connected to a single-plate condenser used as a trimmer across one section of the ganged unit. The noises were found eventually to be due to the central spindle touching the sides of the main spindle, in spite of the fact that both spindles were connected to bushes which were provided with eyelets and were earthed. The way the trouble was finally cured was by connecting a lead to the very end of the spindle (just behind the control knob) and taking this direct to earth.

The Applausograph

YOU will remember my mention of the relay recording device and also the suggestion which followed it concerning an instrument which recorded how listeners were listening? Now comes another machine, but this time one which has been tested and approved and which judges the popularity of an entertainment by the amount of applause which is given. This machine has been developed by the Marconiphone Company, and is very much more sensitive than the human ear, which, of course, could not distinguish between 500 people clapping and, say, 550 people.



A new use for the radio.

It consists of a machine having a microphone, amplifier, and a registering meter. The microphone picks up the applause, converts it into electrical impulses, which are then amplified and passed to the meter. This consists of a glass-fronted box having two rollers, one at each end. One of these rollers carries a roll of graph paper, which passes beneath the glass cover to the other roller. Between the surface of the paper and the glass is a long needle which is called the stylus bar. This bar is supplied with a steady flow of ink, and the whole apparatus may be compared to the barograph which is used for recording changes in atmospheric pressure.

The mechanism inside this box is designed to pass the paper from one roller to another

(Continued overleaf)

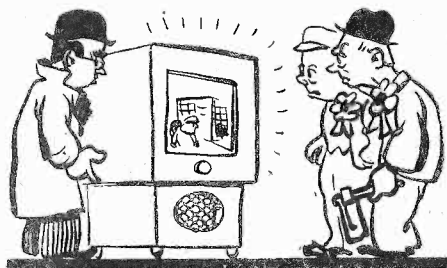
(Continued from previous page)

at a speed of 9 ins. in three minutes, and as soon as the item being judged reaches its conclusion, the apparatus is switched on and the paper begins to move. As the volume of the applause mounts, so the microphone picks it up; it is amplified and passed to the mechanism connected to the stylus bar. * This immediately begins to move under the influence of the applause, and traces a thin black line upon a chart. It will be seen, therefore, that the greater the applause, the greater will be the deflection of the needle, and consequently the higher will the black line rise upon the chart. In this way a permanent, visible, and valuable record of applause given to any particular item is easily and accurately recorded.

These charts are made of semi-transparent paper, and those for each item will be placed upon a ground glass screen having a strong light beneath it. They will be superimposed one upon the other, and the light shining through will give an instant and accurate comparison, thus the judging will be absolutely fair to everyone and will definitely be decided by the audience alone.

A Radio Cow

VISITORS to the Ideal Homes Exhibition who are radio fans are very interested in the radio cow which is supposed to be gifted with remarkable intelligence.



Television at the football match.

This animal, named Chrissie, is led up and down the United Dairies' exhibit and the visitors simply whisper in its ear, when it loudly proclaims the answer to the problem which has been set, or gives the date of any event. Of course, every modern scientifically-minded person immediately says that there is a loud-speaker inside it, and that a human being is secreted therein. But the latter is not true, although obviously a loud-speaker is responsible for the voice. But the mechanism which picks up the visitor's voice, selects the necessary answer, and gives tongue to it, is of an ingenious and intricate nature, and in this case has been devised by the Philco Company, who are also responsible for the public address equipment on this particular stand.

These robot mechanisms are extremely interesting, and it is most amusing to stand outside a crowd watching a demonstration and listen to the comments. Some most ingenious statements are made, whilst also there are a number of ridiculous remarks. I remember going to a very early demonstration of one of these robots, and in this case a sound-on-film track was installed, and a most ingenious selector device which, the inventor assured me, could not make a mistake provided he himself asked the question. Intonation had a great deal to do with the operation of the mechanism, and he had recorded practically all of the well-known historic events, dates, and other popular figures which were always asked by the audience. It was very expensive to operate, but gave a remarkable display of intelligence.



Portable Receivers

AS summer is approaching, many readers will probably be thinking of building a portable receiver. The frame aerial type of portable has lost its popularity during recent years and it is now customary to use a sensitive receiver in conjunction with a throw-out aerial. This type of aerial can consist of approximately 20ft. of flexible wire, which may be conveniently coiled inside the receiver cabinet when not required. When reception is desired in the open, the wire may be uncoiled and thrown over the branch of a tree, and a moderately efficient earth will be provided by tying a piece of bare wire to a screwdriver and pushing the shank of the latter into the ground.

Frame Aerials

THE frame portable is not obsolete, however, and we are now receiving quite a number of inquiries concerning the construction of frame aerials. Many readers ask us to let them know the number of turns they should use, but omit to state the size of the frame. The number of turns required is, of course, governed to a great extent by the dimensions of the frame. With the normal-sized frame (between 12in. square and 15in. square) approximately 70ft. of wire should be used for the medium-wave winding, and approximately 180ft. for the long-wave winding. If the frame is to be fitted with a reaction winding this should have a length of about 15 to 20ft.

Baffle Boards

MODERN moving-coil speakers of reliable design give an even response between approximately 50 cycles and 8,000 cycles, provided that they are correctly mounted. In most cases best quality reproduction is obtained when a large baffle-board is used. If a good response at 50 cycles is desired this baffle should be at least 3ft. square, and a 6ft. baffle may be used to advantage if space permits. If the speaker is mounted in a cabinet the baffle size is measured by adding the diameter of the cabinet face to the depth of the sides. If a very deep cabinet is used, however, a boomy effect is often produced owing to resonance. If it therefore advisable to use a shallow cabinet with the back completely open, and the wood should be at least 1/2 in. thick; if the thickness of the cabinet sides is less than this the inside should be lined with a non-resonant substance such as pulpwood.

Delay Switch

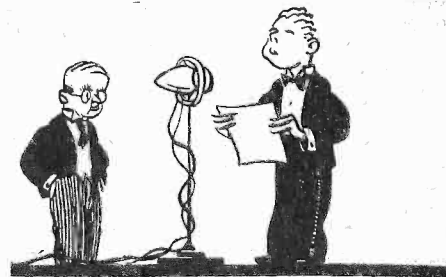
WHEN the voltage required on the anode of the output valve greatly exceeds that required by the preceding valves it is very desirable to use an indirectly-heated rectifying valve in the mains unit, otherwise a voltage surge will occur during the heating-up process and damage may be caused to condensers in the L.F. and H.F. circuits. A case in point is the quality type of set using a P.X.25, or similar type of valve, in the output stage preceded by indirectly heated L.F. det., and H.F. valves.

The Deaf and Dumb and Television

AT a lecture given recently on various aspects of television the subsequent discussion brought out very clearly that the high-definition television service would prove of extreme value to those persons who are deaf and dumb. At present they are unable to take advantage of ordinary radio in the home, but those who know and use the lip language are looking forward to the new service with keen anticipation. The clarity of the pictures received should ensure that deaf and dumb people will be able to see lip movement, and so enjoy at least some sections of the programme, a factor denied to them with sound alone. To this end it is suggested that some manufacturers should give serious consideration to the marketing of a vision set alone and so reduce the cost to those who from force of circumstances have no use for the accompanying sound. Furthermore, there may be many people with ultra-short-wave adapters fitted to their ordinary radio sets who would welcome this policy, so the suggestion is one which merits consideration.

A New Experience

EXPERIMENTS on quite a large scale are now being conducted by a Harley Street specialist, with a view to inducing sleep through the medium of both sound and colour. The doctor claims that with



Talking with a sweet in his mouth.

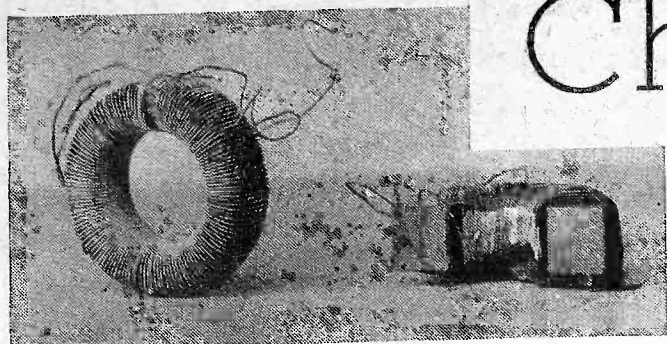
the correct lighting, coupled with soft music and talk suggestion, it is possible to bring about the condition of drowsiness and finally sleep, so that the subjects awake much refreshed. Looking well into the future he is already contemplating the time when the B.B.C. will operate to the extent of radiating slumber music, associated with the appropriate colour combinations radiated *via* the medium of television. The sarcastic will say that certain programmes now provided by the B.B.C. bring about a similar condition, and in any case the state of perfect monochromatic television has not yet been reached, so why prognosticate on what might happen with pictures in colour?

An Interesting Competition

THERE seems to have been a recent state of films which have introduced television in one form or another into the plot. Some are quite futuristic and savour of the stories of Jules Verne, while others merely look ahead to the time when television and the telephone are definitely linked together. To add a spice of material interest in the case of one film using television, a competition has been arranged whereby patrons to the cinema are asked to memorise four short sections of the dialogue, and then write a short criticism of the film. The prize in this contest is a Baird television receiver installed complete in the winners' home, with free service when necessary. Needless to say, since there is no entry fee, the number of competitors has assumed very large proportions.

Chemistry in Radio-1

In this Article Some Interesting Particulars Covering the Manufacture of Powder-iron Cores, and Their Characteristics, are Given. By G. V. COLLE



An experimental toroid coil, shown complete and in section. Note the spaced winding on the larger core.

IN common with many components used nowadays in radio receivers, iron-cored coils are the result of the work of a number of radio engineers, rather than one individual.

Their evolution dates back about eighteen years, and corresponds with the introduction of iron-cored loading inductances for telephone systems. To be strictly accurate, the use of iron cores in such circuits dates back long before 1916, and it is believed only a little while after Pupin originated the idea. The early loading coils, however, were fitted with iron cores consisting of bundles of fine iron wires, to be followed later with laminated iron strips, and similar variations.

Subsequent experiments indicated that greater intelligibility of speech could only be obtained by increasing the frequency spectrum, and this necessitated increased efficiency at the higher audio frequencies.

Engineers quickly discovered that subdividing the known types of cores partially brought about the desired results, although not to the extent required, and the first patents, Nos. 103,188 and 107,007, filed in 1916 by the original Western Electric Co. disclosed for the first time means of manufacturing cores from powdered iron.

It is an interesting fact that criticisms of then-known methods of iron core manufacture apply, perhaps in a more critical sense, to some present-day versions: "Attempts to increase the permeability beyond a certain point are frustrated by accompanying excessive hysteresis and eddy current losses, and by impairment of magnetic stability."

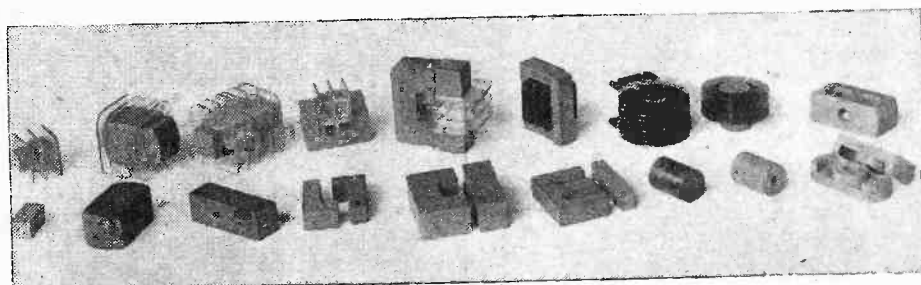
Iron Core Characteristics

It would be as well, at this stage, prior to describing the various commercial systems of manufacture, that a concise idea be obtained of the various core features. These have been clearly set out and described in PRACTICAL AND AMATEUR WIRELESS many times before, but it is necessary to summarise them here. For our present purpose, we can classify the factors which govern the efficiency of an iron core as follows: (1) Material characteristics, (2) Magnetic constituent, (3) Insulating constituent, (4) Configuration — characteristics, (5) Variation of actual permeability with frequency, (6) Effective permeability of iron-powder agglomerates, (7) The dependence of hysteresis on mechanical and thermal history, (8) Effective hysteresis of iron-powder agglomerates, (9) Variation of hysteresis and hysteresis loss with frequency, (10) Retardation loss, (11) Resistivity, (12) Eddy current losses at high frequencies, (13) Dielectric losses, (14) The total core losses expressed as a power factor.

To understand in detail the technical aspect of each of these investigations necessitates a profound knowledge of magnetism, electricity, mathematics, and coil practice.

However, it is significant that even those engaged in this branch of electro-chemical engineering have so far been unable to evolve experimental means or formulae for assessing the actual specific hysteresis-loss per cycle, beyond estimating that it increases with frequency. The A.C. factor, known as "retardation loss" is also unknown at radio frequencies. Owing to differences in technical circles as to the means of considering dielectric losses, their magnitude and variation so far have not been exactly computed. Hence the comparative "goodness" of any core can only be incorrectly arrived at by measuring its effect on a standard coil of known characteristics.

It seems clear that greater perfection in the operation of iron cores for H.F. circuits will not be attained until exact formula has been evolved to cover the above-mentioned points. There are indications that research will bring about some interesting modifications to existing ideas on the subject.



A group of "Gecalloy" cores and cellulose acetate formers, manufactured by Salford Electrical Instruments Limited.

Furthermore, the production of cores having improved characteristics is bound to popularise permeability tuning. The manner in which such tuners operate was explained in an article by the writer on "Modern Coil Connections" in the Feb. 22nd issue of this journal.

Powder Iron Cores

Basically, all powder iron cores are similar, consisting mainly of iron "powder" and a very small proportion of a binding medium. The size and variety of magnetic iron particles, and the insulating binder, vary according to the use to which the core is put, but the total content of the core remains substantially within the following limits:—

Iron 90 to 98 per cent. Insulating and/or binding medium 2 to 10 per cent. In popular parlance, the chief object of the core manufacturer is to put as much iron powder as possible into a given space, so as to provide a high "apparent permeability" factor combined with low core losses.

The maximum amount of iron powder that could be introduced into the "given space" is obviously an amount equivalent to a solid iron bar of equal dimensions. It follows that the iron powder would have to be highly compressed to make one homogeneous mass, necessitating a truly colossal pressure. In actual fact, owing to the 2 to 10 per cent. insulating binder, the most highly compressed powder iron core can never reach the same specific density, and hence the same weight, as a solid iron bar.

Apart from the necessary insulating binder to make the minute iron particles adhere to each other, the latter usually have a fine iron oxide coating which ultimately reduces the weight of the compressed mass. Assuming a standard square bar powder core is to be made $1\frac{1}{8}$ ins. long by $\frac{1}{4}$ in. square in a steel die fitted in a press having, say, a pressure of 200,000 lbs. per square inch, the factors which will govern the permeability of the finished core will be: (1) the size of the iron particles, (2) the composition of the iron particles, (3) the method of coating the particles to insulate them electrically, (4) the quantity of insulating binder to insulate

the particles magnetically and to render the mass homogeneous.

Testing an Iron Core

A most interesting test which the reader can apply is to measure the D.C. resistance of a powder bar core and a solid iron core of similar dimensions, and to the sizes given above. The solid iron bar will show a resistance which is but an infinitesimal fraction of an ohm, whereas the powder core (such the Standard Telephones type) will offer some 7,000 to 10,000 ohms, measured from end to end with point contacts. Considering the weight of the powder core is little short of the solid bar, the test shows a truly wonderful insulation between the iron particles. One may assume that the higher the resistance the more perfect the insulation and the lower the losses. Presumably, if these features could go hand-in-hand with the existing weight of iron particles (and not by employing a

(Continued overleaf)

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greater quantity of insulation), it would lead to the evolution of a more perfect core.

Preparing the Iron Particles

The methods employed in preparing the iron particles, insulating, and binding them together are the subjects of numerous patents. It has already been stated that Patent No. 103,188 is one of, if not, the earliest granted, and this discloses a process whereby thin sheets of iron obtained by electrolysis are broken up into small pieces and cominuted or reduced to small particles in a ball mill, to a size which allows them to pass through a hundred mesh screen.

Such particles are then annealed in a furnace to rid them of occluded gases, such as hydrogen. The annealed particles are insulated by oxidising the surfaces merely by a "rusting" process, which entails adding 10 per cent. by weight of water and heating and stirring the mass until dry. Large eddy current losses are avoided by compressing the treated particles into bars not thicker than $\frac{1}{16}$ in., but preferably into thin sheets. The pressure employed is such that the particles are interlocked by distorting them beyond their elastic limits. Cores from the thin sheets can be built up from twelve to fifteen sections with suitable insulating materials between each sheet.

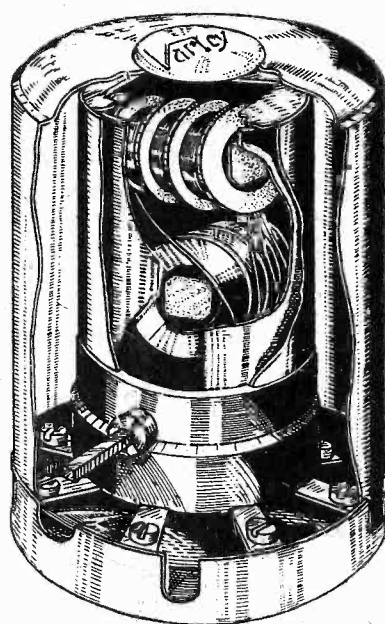
On the basis of present knowledge the method disclosed shows that the permeability factor cannot be high owing to the not inconsiderable amount of iron oxide insulation involved.

A later patent, No. 107,007 by the same company shows an improved method of manufacture. Here the iron particles are similar to those mentioned in Patent No. 103,188, but the powder is annealed at 760° C. in a furnace in a manner which does not allow the particles to oxidise. They are subsequently tumbled in a drum for about 36 hours, pieces of "feathered" zinc (produced by pouring molten zinc into water) being introduced to dry galvanise them. It should be noted that this process only magnetically insulates the iron particles. After "screening" the powder through a sieve to remove the lumps of zinc, it is immersed in a bath of weak shellac solution to insulate the particles electrically. The final method of making the cores is exactly the same as for the original type.

Early "Atmalloy" Coil

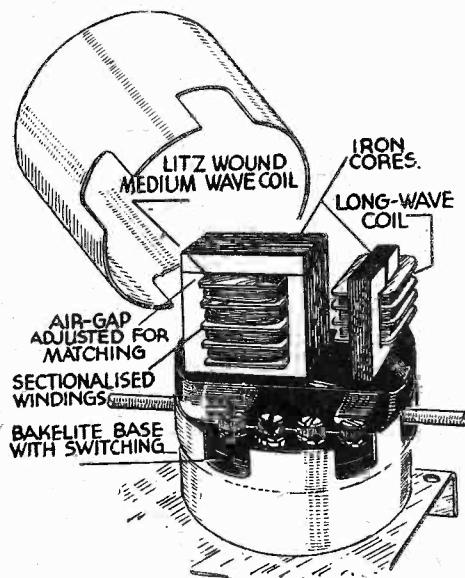
An iron-cored coil of an early type which the writer tested some years ago was the toroidally-wound "Atmalloy" made under Pat. No. 301,784. Although these coils showed distinct promise, their manufacture for radio purposes was not continued so far as it is known. Nevertheless, their core construction is of interest, because it provides another example of the ingenuity displayed in insulating the iron particles. Use is made of commercial iron powder (containing 2 to 8 per cent. silicon), which is annealed in a furnace at 660° C., in airtight pots to prevent oxidation. This annealing process, by the way, prevents the iron from retaining magnetism, and is equivalent to the use of charcoal iron or Stalloy, as compared to mild steel in the construction of bells, A.C. transformers, etc. Provision is made for magnetically separating any iron particles which have not been properly annealed, so as to improve the core characteristics.

After heat treatment, the iron powder is immersed in "Bakelite" synthetic resin varnish of suitable consistency. Air-drying with the insulated iron particles in a state



Part-sectional view of the Varley iron-core tuning coil showing its construction. Note the position of the coils for preventing interaction.

of agitation follows, and the then dried powder is stoved at 250° C. to polymerise the resin, to render it insoluble in the solvent used, and to make the whole heat-resisting. In this final state the iron particles are substantially electrically and magnetically insulated. However, a second coating of varnish is applied and air dried, but not stoved. The powder is ultimately compressed at 20 to 40 tons



The Colvern iron-cored dual-wave tuning unit.

per square inch (this is about half the pressure used on Standard cores) in ring-shaped moulds or dies heated to about 120° C. Ringed cores so produced are claimed to have a specific gravity of 6.2, but a further heating process in an oven at 150° C. follows in order to stabilise the synthetic resin and exclude any volatile matter.

Aladdin-Polydoroff Cores

These cores, together with the associated windings, are covered by about twelve patents. Four grades of cores A to D are manufactured, their construction being on similar lines to those already described. The binder employed is a phenol-resin or

moulding powder, and this substance, combined with very high pressure and heat treatment, results in cores having strong physical characteristics, which can be mechanically worked, turned, or threaded. According to published details, the specific gravities vary between 4.8 and 5.3, which would lead one to assume that a somewhat larger quantity than usual of binding material is employed, which is offset by higher compression, and hence the incorporation of a greater quantity of iron powder than what is usually possible.

We are not concerned here with the core shapes, as obviously, by the use of suitable dies, the "finished" iron powder can be moulded to any desired configuration, and thickness, within its desirable electrical and high-frequency limits.

Recognition of some of these facts, apparently, led to the claims made in Pat. No. 286,800, wherein the use of suitably prepared thin sheets of compressed iron powder interposed with solid iron laminations are claimed to improve the magnetic linkage of windings beyond that possible by the use of laminations above. Material made under this patent (it was little, if ever, exploited commercially) would apply more to coils used exclusively for low radio frequencies such as I.F.T.'s and to L.F. components.

Other Outstanding Patents

It would be impossible to describe here in detail all other patents on the manufacture of cores, because of their number. Outstanding among those filed in England are those due to the G.E.C. (Gecalloy), Paul D. Tyers (Nucleon), one due to the writer, comprising iron-charged cellulose acetate film, which is also coated on both surfaces, and numerous patents of importance due to Hans Vogt, covering the manufacture of "Ferrocort." The last-named core material has been well commercialised, a separate company having been formed to take over its exclusive manufacture.

Ferrocort differs materially from compressed iron cores, since fundamentally fine iron particles are deposited on rolls of paper which are then dried and compressed together. The process, briefly, is as follows. Iron particles, ellipsoid in shape and held in suspension in an insulating solution, adhere to a thin roll of insulating paper which is passed through the trough containing the former. The iron-covered paper strip then passes under combs, which stroke the insulated iron particles into the rows of equal width. Farther along, the strip passes through a coil connected to a D.C. supply, which excites the particles, in so far as to twist and align them so that they are end to end. This magnetic alignment causes the particles to separate transversely, due to their mutual repelling force caused by similar polarity. An orderly arrangement of the iron particles such as described provides these advantages: (1) the end surfaces, being difficult to insulate, are directed longitudinally to form an insulated broken up "filament" in the direction of the magnetic flux; (2) metallic contacts, where they occur, do not encourage eddy currents; (3) improved magnetic conductivity.

In consequence of these features, it is impossible to obtain a resistance reading across a built-up bar of Ferrocort, showing that electrical conductivity at least is non-existent. The building up of cores from numerous "sheets" reduces capacitive eddy currents to a minimum—a most important feature.

(To be continued.)

A PAGE OF PRACTICAL HINTS

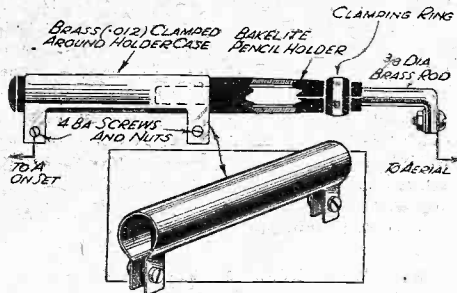
SUBMIT YOUR IDEA

READERS WRINKLES

THE HALF-GUINEA PAGE

A Novel Pre-set Condenser

WHILST experimenting, I was unable to find a suitable semi-variable small value condenser, and ultimately constructed a very efficient component from an old bakelite pencil holder as

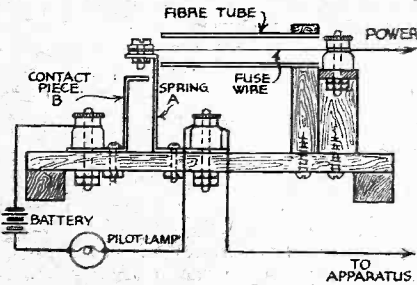


A small capacity pre-set condenser.

described in the following paragraph. The lower end of the holder was covered for approximately 2 1/2 ins. with a piece of brass (.012 in.) sheet, and clamped in position with two 4BA brass screws and nuts; the latter also served as terminals, whilst a brass plunger was made of 3/8 in. diameter rod, and clamped by the ring inside the holder, as shown. Thus the case was used as the dielectric and the capacity could be easily varied by clamping the plunger in various positions inside the pencil holder.—W. A. Harrison (Aintree).

An Alarm Fuse

THE accompanying drawings show an easily constructed fuse which, when it blows, may be made to give an audible or visual indication of its fusing. The fuse wire is stretched between two points, one



An easily-constructed fuse which gives an audible or visual indication when it blows.

is a terminal mounted on a small strip of ebonite fitted on wooden blocks about an inch above the baseboard, and the other consists of a small screw, nut, and washers mounted on a spring brass strip about 3/8 in. wide, shaped and fixed to the baseboard, as shown. The fuse wire maintains this spring strip in a state of tension, and when the fuse blows the spring makes contact with a second brass strip of stouter material and mounted a short distance away from the first strip. A circuit may thus be completed between the two strips to ring a bell or

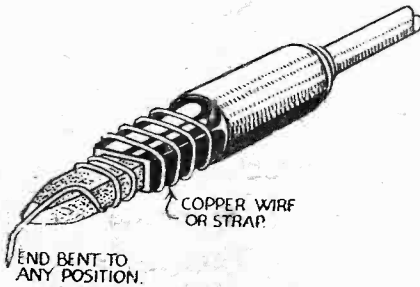
THAT DODGE OF YOURS!

Every Reader of "PRACTICAL AND AMATEUR WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL AND AMATEUR WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be original. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

light an indicating lamp. The fibre tube is merely a refinement to enclose the fuse wire and is glued into a small block of wood fixed to the base. Obviously two or more of these fuses can be fixed side by side, utilising the same terminal mounting strip and fibre tube mount, the contact springs being all connected to a common alarm circuit.—J. HADDON (Ibrox).

An Electric Soldering-iron Tip

HERE is a wrinkle for soldering delicate moving-coil instrument leads and wires in awkward places in modern set

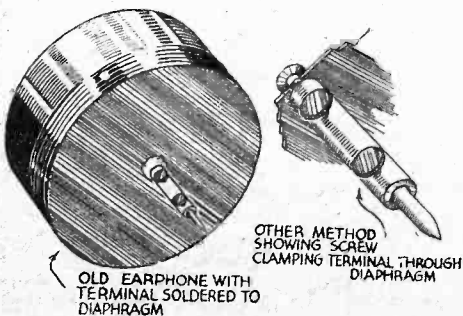


A useful soldering device for fine wires and awkward corners.

chassis, which cannot be reached with the usual soldering-iron tip. Simply wrap a piece of annealed thick copper wire or copper strap around the copper bit and bend the end to the desired position, as shown in the sketch. For meter repairs a smaller diameter wire can be wrapped around the bit.—J. E. RYAN (Cape Town, S. Africa).

An Improved Pick-Up

AN efficient pick-up can be made from an old ear-telephone in the manner illustrated in the accompanying sketch.

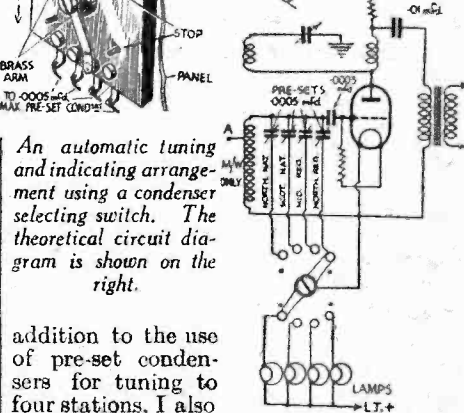
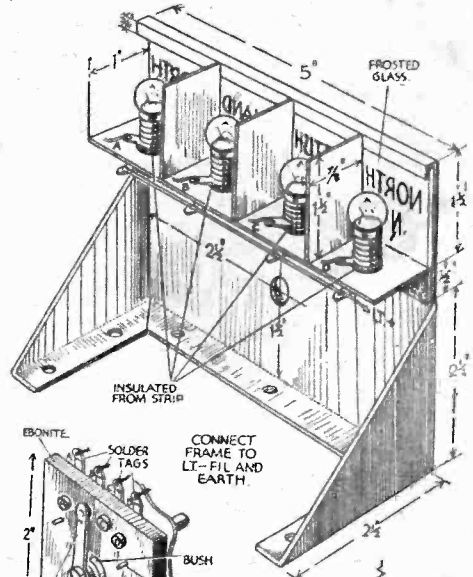


Adapting an old ear-telephone for use as a pick-up.

One end of a double-ended connector is soldered to the centre of the 'phone diaphragm, so that the other end in the connector, with one of the clamping nuts, protrudes through the centre hole in the 'phone cap. An alternative method is to fix the end of the connector to the diaphragm by means of a small screw, as shown in the right-hand sketch. When in use an ordinary gramophone needle is fixed in the end of the connector by the small clamping screw.—J. PLATEN (Brixton).

Automatic Tuning

AS I had to design an automatic receiver for some old people, I incorporated automatic signalling at the same time, and the attached sketches show the complete arrangement. It will be seen that in



An automatic tuning and indicating arrangement using a condenser selecting switch. The theoretical circuit diagram is shown on the right.

addition to the use of pre-set condensers for tuning to four stations, I also incorporated a fixed reaction circuit and made the condenser selector switch also change the small pilot bulbs housed in a small metal chassis behind windows carrying the station names. The framework is of aluminium, which is light and easy to work, and the entire assembly is very small indeed. Care should be taken to ensure that the ebonite spacer is large enough to keep the ends of the studs from touching the metal frame.—J. McLELLAND, (Liverpool).

Practical Television

April 11th, 1936. Vol. 2. No. 24.

CATHODE-RAY TIME BASES.

The Characteristics of these Television Circuits are Described in this Article.

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

THE electrical time base, having the dual function of providing the H.F. and L.F. current variations necessary to produce the fluorescent spot movement in a cathode-ray tube, is an extremely important piece of apparatus. Any failure to generate the correct saw-tooth action previously described will result in an imperfectly constructed picture, so that a fair knowledge of its characteristics is essential if the best results are to be obtained by the user.

Two Important Points

First of all, it should be quite linear in action, that is to say, the velocity of trace must be uniform with time. If this is not so, the picture will exhibit a crowding effect at the end traces in both the horizontal and vertical directions, and a reconstitution of the televised scene in its true dimensional ratios becomes impossible. Again, the flyback or return stroke at the end of each line and picture trace must be sufficiently

referring to Fig. 2, which shows the static characteristic for a pentode valve under these conditions of working.

Action

Referring back to Fig. 1, therefore, the action involved in producing the saw-tooth

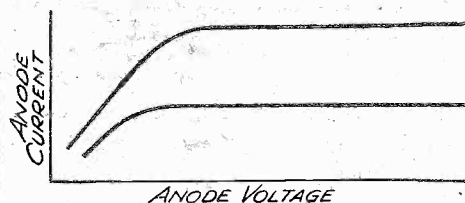


Fig. 2.—Showing how with a screened pentode valve the anode current is constant after a certain minimum anode voltage is reached.

pulses follows somewhat on these lines. First of all, the bias conditions for the indirectly-heated pentode valve are set by potentiometer adjustments as shown, the main H.T. supply voltage value depending primarily on the total voltage required in order to make the beam of electrons in the cathode-ray tube make a full sweep across (or down) the available screen area on which the television picture is reconstituted.

The steady current from the valve V1 passes into the condenser C, and so charges it up uniformly. Due to this steady feed, the voltage across the plates of C rises uniformly with time which, as we saw earlier, was necessary to secure linearity of action in the time base itself. Neglecting for the moment the gas-filled relay, V2, which is in parallel with the condenser, C, the steadily rising voltage will be imparted to the pair of electrostatic deflecting plates marked "shift" and "scan" respectively in Fig. 1. The changing electrostatic field of force concentrated between the plates, and between which the beam of electrons is made to pass on its journey to the fluorescent screen of the tube, will cause the beam to move horizontally or vertically, depending upon whether the plates themselves are mounted in a vertical or horizontal plane. On the completion of the spot trace across the screen it is necessary to restore the electrical conditions to those which operated at the beginning, and it is here that the gas-filled relay V2 comes into action.

The Gas-filled Relay

Whereas in an ordinary valve the glass envelope is exhausted, with these relays a filling of mercury or helium vapour is given at a certain pressure during the

course of manufacture. Furthermore, the current passed through the device is not a flow of electrons in the same sense as a receiving valve, but is an actual arc discharge between the positively charged anode and the heated cathode. This discharge is brought about by the process of ionisation, and for given conditions of electrode separating distances, gas pressure etc., there is a very definite minimum voltage, which must be reached before the arc or visible ionising discharge can take place inside the valve.

Then, again, the grid performs a function which differs from ordinary valve technique. Variations of anode current are not brought about through the medium of this electrode, but it alters the anode voltage value at which ionisation occurs in the relay. This measure of control is expressed as the "grid control ratio" which, in terms of figures in the case of a relay having a ratio of 25 and a negative grid voltage of 8, means that it would require $25 \times 8 = 200$ anode volts in excess of normal to cause an arc discharge.

Limiting Resistance

The grid exercises no further control when ionisation is present, and the discharge is stopped by interrupting the anode circuit or reducing considerably the voltage. Since the internal impedance drops to a very low value under ionising conditions, a limiting resistance is included in the anode circuit, as shown in Fig. 1, to ensure that the anode current does not exceed the maker's rating.

Different relays have different characteristics, but in Fig. 3 is reproduced the average characteristic curve for an Osram gas-filled (mercury vapour) relay type G.T.1, and it is seen that to increase the sweep voltage both the anode and critical negative grid volts need to be increased accordingly.

Having appreciated the relay's inherent action it is easy to see now how the time base functions in its saw-tooth manner. The steadily rising voltage across the condenser C (and hence between anode and cathode of the relay) makes the fluorescent spot move at constant velocity in its direction of trace until the limiting voltage set by the negative grid-bias and grid-control ratio is reached. Ionisation occurs at once, the voltage drops, and the condenser is discharged rapidly. This brings about a collapse in the electrostatic field between the pair of deflector plates, and the fluorescent spot flies back to its original datum line. The initial conditions being thus restored, the process begins all over again, and this spot motion (resembling somewhat that of a cam action) is repeated a number of times per second.

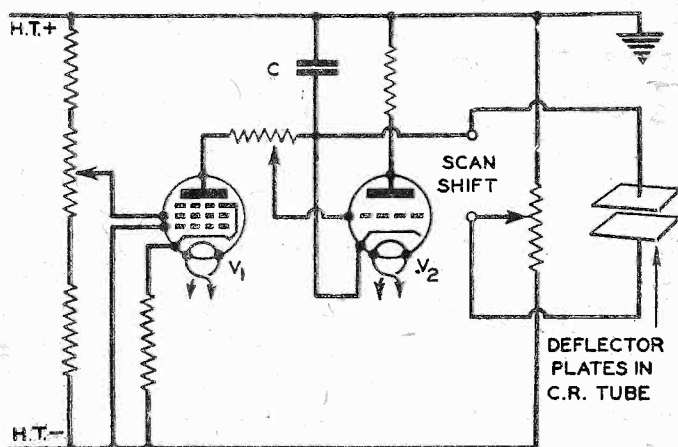


Fig. 1.—A typical time-base circuit using a pentode valve and a gas-filled relay.

rapid to remove any diagonal bright white lines across the picture. In developing time bases to conform to the rigid standards of television, many schemes have been tried, and although perfection has not been reached the arrangement shown in Fig. 1 is representative of a good quality time base scheme for use in conjunction with electrostatic deflection.

A simple form of time base, using a neon gas tube in conjunction with a diode valve, has been illustrated before to indicate the principles of action, but this arrangement suffers from many drawbacks. The voltage range between the values for ionisation to start and stop in the neon lamp is limited, while, in addition, the diode valve functioning in a saturated condition is unreliable. It is preferable, therefore, to replace the neon lamp with a gas-filled relay, and the diode valve with a pentode valve whose operating voltage conditions are such that the anode current remains constant over a relatively wide range of anode voltage variations. This fact can be verified by

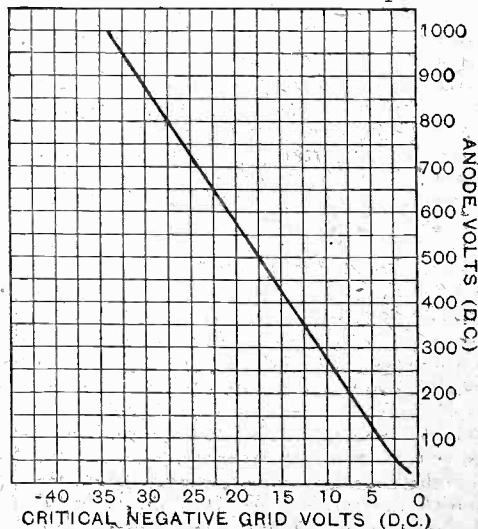


Fig. 3.—The characteristic curve of a gas-filled relay.

REPLIES IN BRIEF

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

A. S. D. (Harrogate).—The arrangement should be quite satisfactory, and the number of valves would depend upon the type of recording. No doubt, two valves would be adequate, and the arrangements of mike and cutting stylus would have to be chosen by experiment.

G. J. C. (N.W.2). We have no details of a superhet of the type mentioned in your letter.

R. A. (Swinton). The component in question is a standard tuning coil, covering the same range as the aerial coil. This is known as a tuned-anode coil. The crystal may be obtained from Electradix Radios, of Upper Thames Street, London, E.C.

J. Q. (Ramsey). The lack of voltage can only be due to a resistance in the L.T. wiring, and if the reading across the valveholder is only 1 volt, whilst all valves are out of the sockets, and at the accumulator it is 2 volts, we suggest that you examine the L.T. battery leads as well as the wiring in the set. Make certain also that the switch is clean and making good contact.

J. F. McL. (South Shields). It is impossible to give you the details asked for from the information supplied by you. No doubt that is why the firms in question did not give you satisfactory replies. If you will send a sketch of the set or give some further details we will endeavour to help you. There are many 7-pin valves, and the circuit employed must be known before the connections can be given.

N. L. (Bradford). The noises may be atmospherics, or local interference which is not picked up on the local due to the fact that you use an H.F. volume control which reduces sensitivity on the local.

W. S. (High Wycombe). You do not state what source of H.T. supply you are employing, and this may be the cause of the trouble. There should be no hum with a battery receiver, and this leads us to suppose that you are using a battery eliminator, which is unsuitable for this particular receiver.

A. R. (West Bromwich). We have not carried out any experiments in the direction mentioned in your letter, and are unable to advise you on the matter.

C. K. A. (Blackpool). The choke in question should be quite suitable, as also should your valve.

J. B. (Low-Fell). Full details of the set in question may be seen in PRACTICAL AND AMATEUR WIRELESS dated August 31st, 1935, and this issue may be obtained, price 1d. A blueprint is also obtainable (PW56), price 1s.

J. G. S. (Earl's Court). The crystal may be obtained, price 6d., from Electradix Radios, Upper Thames Street, E.C. A complete detector using the crystal is obtainable from the same source, price 2s.

R. J. G. (Denmead). No further details can be given concerning the transmitter, and if you are eligible for a transmitting licence you would be able to answer the points raised in your letter.

A. J. L. (Willaston). We cannot give the value of the resistance without knowing the current flowing. This will be the total of all the valves in the set, and it should be divided into the grid bias required and the answer multiplied by 1,000. The resistance should be included in the H.T. negative lead.

R. W. B. (Durham City). Back numbers of our issues are obtainable from this office, price 4d.

R. R. R. (Hove 2). The additional voltage is certainly not detrimental, and may be applied continuously in place of the 36 volts originally mentioned.

J. B. (St. Andrews). The trouble may be due to an overloaded H.T. supply, or to some interaction in the wiring of the set. Further details cannot be given without some circuit information and preferably a diagram of the set.

G. A. (Colombo). The blueprint in question costs 6d., but the issue in which the construction was described is now out of print.

R. E. (N.9). The defect is probably inherent in the instrument and it may not be possible to effect any improvement. On the other hand the trouble may be due to the circuit with which it is being used, in which case the remedy is obvious.

R. McQ. (Manchester). Write to the Radio Society of Great Britain, Victoria Street, London, S.W.

A. I. C. M. (Deaf). If your sketch is quite accurate your trouble is due to the fact that you have confused the grid and screening grid terminals on the detector valve-holder. As shown by you the grid condenser and leak is joined to the screening grid and the control grid is joined to the H.T. potentiometer.

C. D. R. (Skerton). We can supply blueprints of the Midget Short-Wave Two (P.W. 38A), or the Ultra-Short Battery Two (W.M. 402), or the Home-Made Coil Two (A.W. 440). The issue in which the construction of the latter was described is now out of print, but back numbers of the other two books are still obtainable.

W. C. (Turners Cross). Your coil idea is not new, but has been described by us on several occasions. It is quite in order and works quite satisfactorily.

A. P. (Everton). The H.T. battery is now probably run down and this would account for the bias not functioning. On the other hand, there is a possibility that the valve has been damaged, due to the non application of the bias and you should therefore have both the valve and the H.T. battery tested. Your difficulty with the Class B amplifier is probably due to the same cause.

L. R. M. (Ghaffont St. Peter). A special Class B mains unit may be obtained and will prove quite satisfactory.

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		Duplex	84/-
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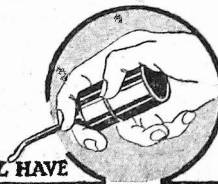
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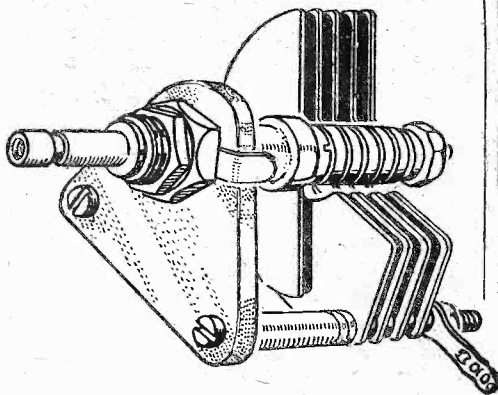
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Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

New Raymart Condensers

SOME new micro-variable condensers are being introduced into the Raymart range, and these will eventually supersede the micro-variables types VC15, VC40, and VC100. In general construction they are similar to those condensers, but possess an end plate of ceramic material which has been specially designed and has a remarkably low-loss factor. It is claimed, as a matter of fact, that this is one quarter of that which is claimed for the well-known American Isolantite. The condensers have the usual brass vanes, and the ball race which is fitted for smooth operation is electrically short-circuited to avoid noises. A direct connection is provided for the rotor section, and this avoids many of the difficulties which are met with in a pigtail, such as noises, variation in tuning due to inductive effects, etc. The condenser is



The new ceramic Raymart micro-variable condenser.

robust and is provided with a one-hole fixing bush, and where it is desired to effect screening from the hand of the operator, or for other mounting purposes, the small bracket shown in the centre of the page will be found ideal. This costs only 3d. and may be used for any standard one-hole mounting device or for extension handles, etc. The reference number of the 100 m.mfd. condenser illustrated is VC100X, and the price is 1s. 10d. Two other types are available, VC15X (15 m.mfd.), costing 1s. 4d., and VC40X (40 m.mfd.), costing 1s. 7d.

New Mullard Battery Valve

A NEW output pentode is announced from the Mullard company, and this is designed for the battery-operated receiver. It is claimed to be the first high sensitivity output pentode ever produced for battery receivers, and in most sets it will be interchangeable with the existing output valve with an amazing increase in volume. The valve is rated at 2 volts .3 amps., and the maximum H.T. is given at 150 volts, which value is applied also to the auxiliary or screening grid. At an average working voltage of 135 volts, with 2.4 volts grid bias, the average anode current is only 5 m/A. This particular grid voltage value is not obtainable directly from an ordinary bias battery (which is, of course, in multiples of 1.5 volts), and therefore it is necessary, in order to take

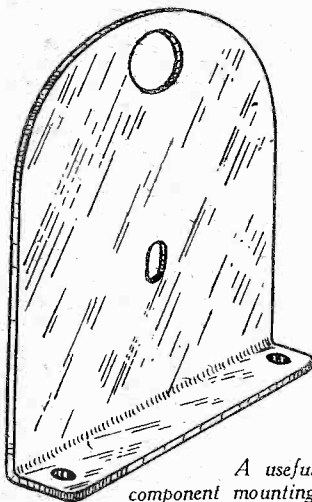
full advantage of the characteristics of the valve, to adopt a different method of obtaining the bias. The simplest scheme is to fit a potentiometer across the grid bias battery, as is done in the case of variable-mu H.F. stages, although, of course, a resistance in the H.T. negative lead may be employed to provide automatic bias of the required value.

To overcome inevitable variations in the consumption of H.T. current when a given output is demanded of individual valves, a system of grading has been adopted by the manufacturers, and this is arrived at in terms of auxiliary grid voltage, and correct replacement has been ensured by marking both valve base and glass envelope with the alternative grade letters A or B. The following table shows the appropriate grades for 120 volts and for 135 volts H.T. supplies:—

Grade	Auxiliary Grid Volts	Anode Volts	Grid Bias Volts	Average Anode Current
A	135	135	-2.4	5 m/A.
B	120	135	-2.4	5 m/A.
A	120	120	-2.4	3.8 m/A.
B	110	120	-2.4	3.8 m/A.

If the valve is used to replace some of the earlier types of pentode of the high output type, there will be a substantial increase in volume without any increase

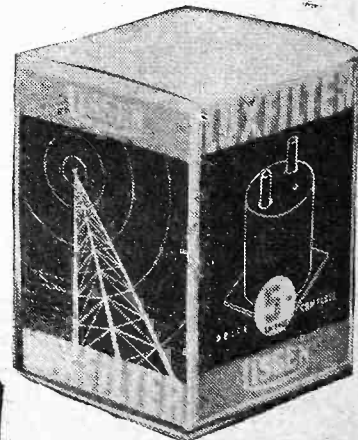
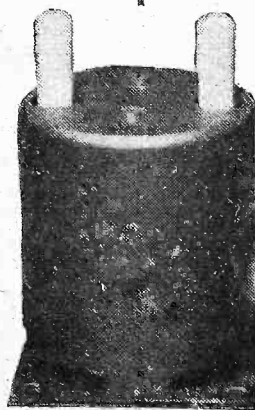
in anode current drain, although, of course, the L.T. load will be slightly increased. The latter point is of no moment in the majority of cases, as it only extends to .1 amp. The price of the valve is 13s. 6d., and the type number is PM22D.



A useful component mounting bracket from the Raymart range.

Pye Service Accessories

PYE RADIO are also introducing to the service engineer some interesting accessories designed to simplify the task of servicing modern receivers, and in the "Trimkit" a number of specially-made trimming tools are to be found in which a material known as "Tufnol" is employed, together with four resistances suitable for loading purposes. These are designed primarily for use with Pye receivers, but they are no doubt applicable to other types of superhet and will be found of the utmost use by service engineers.



This is the Lissen Luxfilter which was reviewed last week.

Another interesting service aid is found in a series of valve adapters for 4-, 5-, 7-, and 9-pin valves. A standard valve base, is fitted with a cable to a standard valve-holder mounted on a small switch panel, and this has sockets which enables meters to be connected to various parts of the valve circuit to measure voltage and current ranges. The Trimkit costs 10s. 6d., and the adapter for 4-, 5-, and 7-pin valves costs 10s. 6d. For 9-pin valves, the price of the adapter is 12s. 6d.

A New Wharfedale Speaker

FURTHER to increase the range of Wharfedale speakers a new Super Bronzian is now being added. This is designed primarily for use as an extension model and is fitted with a universal matching transformer. The "Truqual" volume control is fitted to the cabinet, which is further lined with Celotex in order to improve the tone and avoid difficulties due to resonance. Although designed primarily for use with a number of commercial receivers, the speaker will be found also of general use. The price is £3 7s. 6d., or without the matching transformer, £3.

New B.T.H. Pick-up

THE Minor pick-up, which has for a long time been popular amongst home-constructors, is now available in a lower-priced model with improvements in design which render it still more a valuable accessory for those who are constructing a radiogram or who wish to use their present receiver for record reproduction. In the new model the total weight has been reduced, and the effective weight on the record is now only 2½ ozs. In addition to this, the clamping has been made lighter, and the impedance has been increased. The results of these changes are shown by the fact that the output level has been raised and is now just over 1 volt at 1,000 cycles.

The general appearance of the pick-up is practically unchanged, a one-piece bakelite moulding being employed for the casing, and a volume-control is fitted to the rear, operated by a lever in the base. The resistance of this control has also been increased and is now 30,000 ohms instead of 10,000 ohms. The effective frequency range extends from 50 to 6,000 cycles, and the price is 17s. 6d.

50 Tested Wireless Circuits

By F. J. CAMM

(Editor of "Practical and Amateur Wireless")

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OUR FREE CATALOGUE SERVICE

EDDYSTONE SHORT-WAVE COMPONENTS

EDDYSTONE components are well known to short-wave enthusiasts for their careful design and efficiency, which is the result of years of specialisation and research work. A new list just issued by Stratton and Co., Ltd., covers a comprehensive range of these high-class components, covering every phase of short-wave work. Among the new components listed is an air-dielectric microdenser for general short wave, and made in three capacities varying from 6.75 m.mfd. to 103 m.mfd. There is also a new "Scientific" S.W. Condenser of all-brass construction and soldered vanes, the capacity ranging from 13.5 m.mfd. to 180 m.mfd. This condenser has noiseless bearings, a special screened pigtail, and an extending spindle for ganging purposes. Other new components include a featherweight crossfeeder block of special design, and steel racks suitable for transmitting equipment, public-address amplifiers, and other apparatus. These racks are constructed of pressed sheet steel, and are black ripple finished. The popular types of coils, I.F. transformers, chokes, condensers, and insulators are also included in this useful and well-printed list.

WEARITE COMPONENTS

THE new edition of the Wearite catalogue includes the recently-introduced Uni-gen coil which is a modification of the Universal and Universal Type A coil. In this new model a tapping is provided on the primary winding, and in addition there are other modifications rendering the coil suitable for Universal General use. Also included in this catalogue are the complete range of coils of the air-core and the iron-dust-core types which cover ordinary aerial circuits, superhet circuits, and intermediate-frequency transformers. A useful wave-trap which is suitable for operation on both medium and long waves, and which employs an iron core, Class B and Q.P.P. transformers and chokes, mains components, and a wide range of switches also take their place in this interesting display of components. There are high-frequency chokes for all circuits from the simple type of small choke suitable for ordinary reaction circuits to the high-inductance model designed for H.F. coupling with high-impedance valves, and a short-wave section also provides a good idea of some of the useful short-wave components. A list of the Wearite "350" series of circuit "Black

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prints" concludes this interesting catalogue and a full page is devoted to illustrations of the range of set-testing apparatus which will have a special appeal to the Service Engineer.

BOOK RECEIVED

B.B.C. ANNUAL, 1936

Will the listener of the future watch an orchestra playing throughout an entire concert, or will his listening to its music be merely reinforced by vision from time to time? Will talks be accompanied by continuous or intermittent pictures, showing the speaker or documentary material illustrating his theme, or a combination of both? What will be the effect on speakers if they have to consider the appearance which they are presenting to unseen audiences, as well as the effect of their voices upon them? These and other questions are discussed in chapters dealing with television in the "B.B.C. Annual."

A complete analysis by counties reveals that Selkirk, with 27 per cent., had more licences to population than any other county in the British Isles, at December 31st, 1935. Allowing four or five persons to each household it would seem that saturation point may have been reached in this single instance.

The message broadcast by King George V on the occasion of his Silver Jubilee on May 6th, 1935, and his late Majesty's Christmas broadcast to his people are reproduced in extenso.

The largest section of the Annual deals with British Broadcasting in 1935, sub-divided under programme headings such as music, drama, variety, and talks, and containing in addition informative articles on engineering, finance, and public relations. The whole division forms a comprehensive survey of the activities of the Corporation during 1935.

SPECIAL NOTICE

Indexes for Vol. 7 are now ready, price 7d. each. Binding case and index cost 3/6 by post from Geo. Newnes, Ltd., 8/11, Southampton Street, London, W.C.2.

RADIO CLUBS AND SOCIETIES

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

THE WIRRAL AMATEUR TRANSMITTING AND SHORT-WAVE CLUB

THE inaugural meeting of the above club, was held on March 25th at the secretary's house. There was a satisfactory attendance, and a committee was elected consisting of five of the members. This was followed by the drawing up of a series of regulations, and an informal discussion on "tri-tets." The next meeting is to be held in Heswall on April 22nd. Many more members are required, and those wishing to join should write to B. O'Brien, Hon. Secretary, "Caldy," Irby Road, Heswall, Cheshire.

STRATHAVEN AND DISTRICT WIRELESS CLUB

A MOST interesting and instructive meeting of the above club was held on the evening of Wednesday, March 18th, when twenty-two members were present to hear a lecture on "Mains Transformers and Equipment," given by Mr. J. H. Clow, a member of the Radio Society of Great Britain.

The painstaking care of Mr. Clow to make the various points clear to all was greatly appreciated, and the manner in which he answered the various questions put to him after the lecture showed that Mr. Clow had made a very close study of the subject. This club has recently acquired its own premises which are open every night with the general meeting on Wednesday evenings. An attractive programme has been arranged and any person wishing to join is requested to get in touch with the Secretary, Wm. L. Howat, who will be pleased to give full particulars.

SHORT-WAVE RADIO AND TELEVISION SOCIETY (THORNTON HEATH)

THIS society held their Eleventh Annual Dinner at the Café Royal, Croydon, on Wednesday, March 18th. Unfortunately, the President of the Society, Lt.-Col. Hon. G. K. M. Mason, D.S.O., M.P., was unable to be present owing to political engagements, but during the evening a letter from him was read congratulating the society upon its activities and wishing it success in the future. The toast of The King was proposed by the Chairman, Mr. R. E. G. Copp.

After the dinner a concert was held, the artists being Mrs. D. Sharpe (soprano), Mr. Dudley Marchant (light comedian), Mr. L. Moscrop (baritone), and Mr.

O. L. Crossley, M.P.S. (chemical magic). The accompanists were Mrs. Mitchell and Mr. Webber.

The weekly meeting of the above society was held at St. Paul's Hall, Norfolk Road, on Tuesday, March 24th, presided over by Mr. R. E. G. Copp.

Mr. J. Hodges gave a demonstration of the new model Ekco Receiver AD37. Before demonstrating the receiver Mr. Hodges gave a short talk on its construction and pointed out that reaction was applied and controlled by a pre-set condenser at the rear of the chassis. The valves used are VP 13c, SP 13c and Pen 36c. The receiver is universal, the consumption on A.C. being approximately 81 watts and on D.C. 67 watts.

The meeting closed with a vote of thanks to Mr. Hodges. The Hon. Sec. is Mr. Jas. T. Webber, of 368, Brigstock Road, Thornton Heath.

WELLINGBOROUGH AND DISTRICT SHORT-WAVE RADIO AND TELEVISION SOCIETY

THE first meeting of members of this society took place at the Midland Hotel on March 23rd, and was attended by forty local enthusiasts. After the routine business of the meeting, an address was given by Mr. L. F. Parker, G5LP, on "The Design and Construction of a Modern Two-Valve Short-Wave Receiver." This was followed by questions, and an informal discussion, together with a demonstration of the receiver described in the talk.

All PRACTICAL AND AMATEUR WIRELESS readers in the district who are interested are invited to join, and full particulars and dates of meetings, etc., are available from Mr. L. F. Parker (G5LP), 127, Jubilee Crescent, Wellingborough.

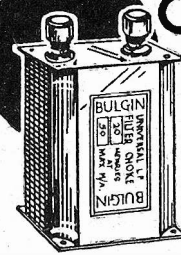
THE CROYDON RADIO SOCIETY

THE meeting on Tuesday, March 24th, of the Croydon Radio Society, in St. Peter's Hall, South Croydon, was of rather a novel nature. Five volunteers were called upon to lecture on any subject they liked for ten minutes. The first was the Technical Adviser, who spoke on how musical instruments worked, how notes were dependent upon their length, and what happened when air started vibrating in them. Mr. J. T. Haynes followed with a story of the weird behaviour of his apparatus, in which the loud-speaker at one side of the room gave full volume even when not connected to its amplifier across the room. Mr. M. G. Firmin, who caused such a sensation with his mica-cone triple speakers at the last loud-speaker night, spent an interesting ten minutes on mica cones, and Mr. V. C. Chubb described his public-address apparatus. The crooner, acoustically on a level with a crystal set, was most difficult to amplify. Finally came Mr. L. F. Marshall, who spoke on the grid system of electricity distribution, having many interesting technical points to relate.

Hon. Pub. Sec., E. L. Cumbers, Maycourt, Campden Road, South Croydon.

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FOR POWER I.F. CHOKES



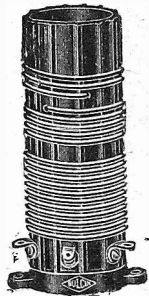
Here is a range of good quality chokes upon which you can rely for efficient and long service. In accordance with modern requirements they are suitable for heavy duty uses, having low D.C. resistance and generous magnetic cores. Aluminium finished metal screening cases for universal mounting.

List No.	H. AT mA Ohms	List No.	H. AT mA Ohms
L.F. 12	10 60 320	L.F. 34	100 10 1,800
L.F. 14	20 50 400		
PRICE 10/6 EACH.		PRICE 12/6 EACH.	

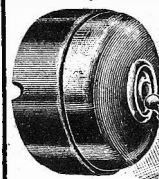
12-95 METRES 3-Range Coils

These three-range short-wave coils may be used in all sets and adaptors of both straight and superhet types. Covering three wavebands 12-25, 24-50 and 46-95 metres approx. One coil has additional windings on each range which may be used for reaction. The second is similarly arranged, with looser coupling for the aerial circuit.

List No. S.W. 65. Aerial Coil.
List No. S.W. 66. Oscillator Coil.
PRICE 3/6 EACH.



RADIO IN EVERY ROOM

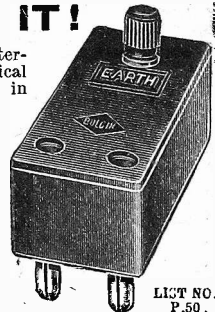


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For parallel connection. Wall Jacks should be used for all Loudspeakers and telephone extensions, thus avoiding possible danger of confusion with heating and lighting main sockets. They are heat and shockproof.

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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).

Reception of U.S. Amateur W2BSD

SIR.—We note that one of your readers, D. C. Locke, of Thorney, raises the subject of the American amateur station W2BSD in the issue of PRACTICAL AND AMATEUR WIRELESS dated March 7th, 1936. For some time past we have been receiving this station almost nightly, and he is probably one of the best U.S. amateur transmitters heard in this part of the country at the present time. The operator is Mr. Ted Healy, and the station is situated at New Rochelle, New York.

In a recent communication he informs us that his carrier is 700 watts, but he can, and does on occasions, increase this to 1 kilowatt at a frequency of 14,170 kc/s.

When reception conditions on the 20-metre band are favourable, his signal strength is regularly R8-9, QSA 5, and he appears to transmit most of the day and every day, except Saturday and Sunday, and may be heard on occasions re-transmitting other smaller-powered U.S. transmitters. Incidentally, the British station he often contacts is G5NI.

In passing, we might mention that the evenings of March 4th and 5th were, in our opinion, the most favourable to the 20-metre band for some months, and some thirty to forty U.S.A. amateurs were logged here on these two evenings.

Trusting the foregoing may be of interest to Mr. Locke and other readers.—NORMAN F. HOLDEN, B.Sc., H. WORSLEY (Assoc. Manchester College of Tech.) (Cheadle, nr. Manchester).

Correspondent Wanted

SIR.—I have been a regular reader of PRACTICAL AND AMATEUR WIRELESS for some time, and I wish you all the success you deserve for a very informative and interesting paper. I should like to get in touch with any short-wave enthusiast in the Royston, Herts, district.—E. P. ROSENDALE (Litlington, Royston).

From a Reader in Cairo

SIR.—In answer to the letter from D. C. Locke (Thorney) in the 7th of March issue of PRACTICAL AND AMATEUR WIRELESS I should like to state that I get W2BSD New York almost every night, or, rather, morning. A further sample of his calls are:

- W2BSD working G5NI (Birmingham)
- W2BSD working G5ML (Kenilworth)
- W2BSD working G6XR (Coventry)
- W2BSD working EA2BP (Spain?)
- W2BSD working ON4PA (Belgium Experimental)

The Birmingham station G5NI is very popular with the Americans and well worth listening to. He also "comes over" at good strength. I should like to add that I always look forward to the PRACTICAL AND AMATEUR WIRELESS mail day, and how much I enjoy reading your excellent paper.—FRANK HARDY (Cairo, Egypt).

Good Reception of Addis Ababa

SIR.—On Sunday, March 22nd, at 21.35 G.M.T. I was lucky enough to hear the first of a series of broadcasts from Addis Ababa on a wavelength of 25.09 m.

The announcer said that the station (ETB) would be on the air again next Sunday night (March 29th) at midnight (Abyssinian time, or 21.30 G.M.T.) with a speech by the Empress of Abyssinia, and every Sunday at this time with other interesting items. The transmitter used was a standard telephone one using $3\frac{1}{2}$ kW power and di-pole aerial. The mike used was of the carbon type, but even so the quality was quite good. Using an 0-v-2 receiver the strength was R6-7 QSA 5. No QRM but slight QSB. Reception reports were invited and were to be sent to "Broadcast," Post Box 283, Addis Ababa, Ethiopia.—A. H. MUSTON (Weymouth).

Short-wave Correspondent Wanted

SIR.—I shall be glad to get in touch with a short-wave listener and constructor in my district.—L. COLLEY (age 16), Seabird Bungalow, Hollym Road, Withernsea, E. Yorks.

Address Wanted

If Mr. Alex. Neill, of Belfast, will forward his address to this office, the back number of PRACTICAL AND AMATEUR WIRELESS he required will be sent on to him.—ED.

Back Number of "A.W." Wanted

SIR.—I should be very much obliged if any reader could supply me (on loan) with a copy of AMATEUR WIRELESS containing the wiring diagram, or blueprint, of the 1933 Ether Searcher. I shall be pleased to pay postage for same.—P. ROBERTS, 37, Princess St., Bury, Lancs.

Correspondent Wanted

SIR.—I have been a reader of your paper ever since it started, and I think it is one of the best wireless weeklies. I should like to see published particulars of a large all-wave superhet. with a push-pull output stage giving 12 watts undistorted output for quality reception.

I am also interested in 5-metre reception, and would like to get into touch with someone transmitting in this district who could help me in building a portable transmitter.—ROWLAND CRETNEY (Didsbury, Manchester).

[If any interested reader cares to write to Mr. Cretney, care of the Editor, the letter will be forwarded.—ED.]

Charging Accumulators

SIR.—Mr. Bolton reproduces part of his letter of Jan. 25th to show that I have misinterpreted the remarks in question. But perhaps a fuller quotation will show that the writer's real intentions were not so apparent as he would have us believe.

"Now, if the accumulator was disconnected with the power still switched on, there will be a potential difference of 250 volts between the cable ends, but, naturally, no circuit will flow as the circuit is disconnected. Bearing in mind that the resistance of a 100-watt lamp only permits the flow of 4 amp. in a closed circuit, if we did, accidentally, touch the live ends (on the accumulator terminals) the shock received would definitely not be drastic

provided the insulation of the mains supply, at this instant, was in good condition. Under normal conditions the person's body would scarcely be passing .4 amp., if we take into consideration the resistance of one's body, plus the resistance of the lamp."

In my criticism, I assumed, from the opening and concluding sentences above, that the person's body bridged the gap left by the disconnected accumulator, thus forming a series circuit with the lamp resistance. If, as the writer says, that is incorrect, how, then, can we "take into consideration the resistance of one's body, plus the resistance of the lamp"?

From Mr. Bolton's drawing, a person touching the accumulator terminals is in contact with the negative main. If he is well insulated, nothing happens. If he is in good contact with "earth," a small leakage current flows in parallel with the charging circuit. In neither case has the lamp resistance anything whatever to do with the result. Least of all does a "virtual short-circuit" take place.—JAMES J. BEVERIDGE (Glasgow).

Reception of VP3MR and W2BSD

SIR.—It may be of interest to Mr. D. T. Donaldson (whose letter appears in PRACTICAL AND AMATEUR WIRELESS dated March 7th, 1936), and other readers, to know that VP3MR, Georgetown, British Guiana, comes in here at R9, dropping to an occasional R7. It fades very little. Its quality is not up to the usual broadcasting standards, but this is perhaps explained by the fact that its power is only 0.05 kW, so that modulation would be sacrificed a little in order to "get over."

Re Mr. D. C. Locke's letter in the same issue of your splendid paper, he may like to know that W2BSD, of New York, on the 20-metre band, is usually an excellent signal here, and is certainly a most interesting station.

I use a very low aerial 15 feet long, and my set is an 0-v-1 with a pentode in the output stage, and all my listening is done on 'phones.—R. P. M. TILLEY (Norwich).

CUT THIS OUT EACH WEEK.

Do you know

—THAT as much as 15 watts may be obtained from a single power valve in a straight mains receiver.

—THAT in the push-pull circuit the undistorted output which may be obtained is nearly half as much again as is obtained from each individual valve.

—THAT an ordinary type of meter cannot be used for measuring the normal current in a Class B stage.

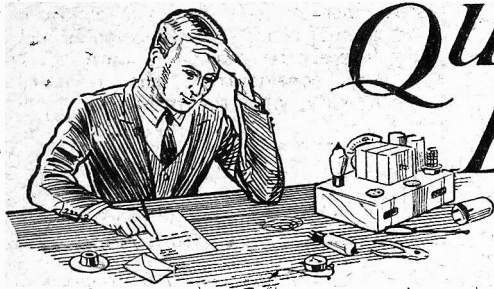
—THAT a badly arranged indoor aerial can be the cause of serious hum difficulties due to induction with mains wiring in the walls.

—THAT a mains receiver should always be joined to the mains via a suitable fuse.

—THAT special paxolin strips are obtainable to assist in the connection of a number of fixed resistances in a receiver.

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

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



QUERIES and ENQUIRIES

present transformer be of any use in this circuit?—B. E. A. (Birmingham).

AS the load of each valve is 2,500 ohms, two such valves in push-pull require a load of 5,000 ohms, and thus, in this particular direction, your transformer is quite suitable. Although the anode current of each valve is 30 mA, this current will pass only through one half of the winding in a push-pull circuit, and thus, although two valves are used, the total current flowing through the primary winding will still be only 30 mA. The fact that the current flows in opposite directions also balances out the usual magnetising effect, and thus the transformer may be used with perfect safety and with maximum efficiency in your proposed push-pull circuit.

Superhet Tuning

"I have decided to build a superhet, and obtained a number of components from a market stall which I recognised as being of standard and well-known make. Unfortunately, in my enthusiasm, I obtained a ganged condenser which was of the equal-section type and, on taking this back, the stall-holder would not exchange it for me. Is there any way in which I can utilise this condenser to save wasting it? I believe it is possible to use fixed or pre-set condensers to make up the circuit, but should appreciate values and connections for the purpose."—B. W. A. (Perth).

WE are sorry that we cannot give the information, although you are quite right in your assumption that the circuit may be built up with fixed condensers. The values of these will, however, depend upon the circuit which is being used and the intermediate frequency which has been selected, and in the absence of such information we are unable to suggest the necessary values and connections. The makers may be able to assist you if you know who made the components, or if you can let us have the necessary details we may be able to supply the correct connections.

The Monitor and a Mains Unit

"Will you please be so kind as to say whether or not the Monitor 3 could be worked to full efficiency from an H.T. eliminator?"—E. V. P. (Malta).

IN general it may be taken that a battery eliminator will deliver a more constant and better H.T. supply than a battery. Against this must be set the fact that the supply may not be so smooth, but it will be maintained at the same level all the time the set is in use and will not fall off after the set has been in use for some time. Thus it may be used with any battery receiver, and the only difficulty likely to be encountered is in instability due to the fact that the load is common to all the anodes. In this respect, however, it is no different from a run-down H.T. battery, and therefore the usual steps of introducing decoupling components in the anode circuit should be fitted, when the mains unit will be found perfectly satisfactory. It is possible in some circuits to dispense with the decoupling components, but they should be fitted as a matter of course when it is intended to use a battery eliminator.

Output Transformer Current

"I have been using a set in which I had the output transformer specially made by a firm which has now gone out of business. It was designed to match a valve having an impedance of 5,000 ohms and the makers provided at the time a centre tap. The rating of this component was 30 mA, and I am now anxious to modify my set to use a push-pull output stage in which I am going to use two valves each of which requires a load of 2,500 ohms and in which the anode current of each valve is 30 mA. Will my

RULES

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

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

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

If a postal reply is desired, a stamped addressed envelope must be enclosed. Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.

Mixed Filaments

"I have a number of old D.C. valves of the indirectly-heated type and should like to incorporate these in a set to work from the D.C. mains. Is it absolutely essential that in these circumstances the heaters must have identical ratings, and, if not, how does one use them? Any other points on this subject will be welcomed."—E. A. S. (Winchester).

IN the usual D.C. circuit the heaters are wired in series, and the current in the heater circuit is limited to a definite value. Thus, each heater must pass the same current, and this necessitates that where heaters of a different rating are employed the circuit must be loaded to provide the equivalent current. For instance, you should select the valve with the highest current rating, and then across the remaining heaters must connect a load resistance to bring the total current up to that of the highest valve, but to leave the correct proportion for the valve in question. As an example, if you are using a valve rated at .2 and one of .1 amps., then the latter should have a resistance in parallel with it which will also consume .1 amps. at the applied voltage. It may in some cases be necessary to adopt both series and parallel connections for some of the valves in order to obtain the desired rating, and thus it is preferable to employ valves having the same rating.

Coil-winding Data

"I wish to wind a coil having an inductance of 200 microhenries. I have a length of paxolin tubing 2in. in diameter and would be glad if you could give me the necessary winding formula for the coil in question."—B. Y. O. (Petersfield).

A SIMPLE solenoid coil would, with 28 D.S.C. wire, using a total of sixty-four turns, be approximately the inductance you ask for. The length of the winding will be roughly 1.13in.

The Earth Connection

"I am rather in a quandary regarding my earth connection. I had just read of the importance of this part of the equipment, and whilst trying for foreigners I found that reaction was much more erratic than usual. I tried one or two things and found that when I took off the earth it made no difference to volume. Does this indicate that the earth is broken, as I am using a buried earth and do not want to dig up the ground unnecessarily especially as a flower bed is now over the earth. I used a flat sheet of copper with the lead soldered to it so I do not think it should be that which is the trouble."—L. A. (Rickmansworth).

THE fact that removal of the earth made no difference may be taken as an indication that it is ineffective. Whether or not this is because the lead has come adrift from the earth plate, or whether the earth is too dry for the connection to function efficiently we cannot say, but an examination of the ground should reveal the latter point. If the plate was buried in clay it is possible for the ground to have dried out and the clay to have cracked away from the plate, leaving a very poor connection. It is always preferable to use one of the special moisture-retaining chemical earths, or to pack coke or similar material round the plate to keep the ground in a moist condition. Thoroughly soak the ground and see if any improvement is obtained. If not, then the plate should be dug up for inspection.

Divided Mains Supply

"I enclose a list of parts which I have and with which I should like to build a powerful mains receiver. The mains transformer is a manufacturer's surplus and is supposed to give 250 volts at 60 mA, but I should like to include a push-pull amplifier on the output side. What valves do you recommend in order to get the utmost from this equipment?"—F. T. (Norwich).

FROM the list of your components you obviously have sufficient to build a good five- or six-valve superhet, but if you wish to include a good push-pull stage there are limitations imposed by the mains supply, which is only 60 mA. Really powerful output valves would take about 48 mA, and two in push-pull alone would run to 80 or 90, without the remaining valves. In this case the best plan would be to obtain additional mains equipment and use the present mains section to operate only the early stages in the receiver, say up to the second detector. The L.F. and output stages could then be designed on really sound lines and operated from their own mains pack. In addition to the advantage gained by using a higher output in this section, there would also be the advantage that hum difficulties would be removed to a very large extent.

The coupon on cover iii must be attached to every query.

Practical and Amateur Wireless BLUEPRINT SERVICE

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STRAIGHT SETS. Battery Operated.

One-valve : Blueprints, 1s. each.

Description	Date of Issue	No. of Blueprint
All-Wave Unipen (pentode)	—	PW31A
Two-valve : Blueprints, 1s. each.		
Four-range Super Mag Two (D, Pen)	11.8.34	PW36D
Three-valve : Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans.))	—	PW10
Sixty-Shilling Three (D, 2 LF (R.C. & trans.))	2.12.33	PW34A
Leader Three (SG, D, Pow.)	—	PW35
Summit Three (HF Pen, D)	18.8.34	PW37
All-Pentode Three (HF Pen, D (pen), Pen)	22.9.34	PW39
Hall-Mark Three (SG, D, Pow.)	—	PW41
Hall-Mark Cadet (D, I.F. Pen (R.C.))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (pen), Pen) (All-wave Three)	13.4.35	PW49
Genet Midget (D, 2 LF (trans.))	June '35	PM2
Cameo Midget Three (D, 2 LF (trans.))	8.6.35	PW51
1935 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	17.8.35	PW53
Battery All-wave Three (D, 2 LF (R.C.))	31.8.35	PW55
The Monitor (HF Pen, D, Pen)	8.2.36	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	7.12.35	PW64

Four-valve : Blueprints, 1s. each.

Fury Four (2 SG, D, Pen)	—	PW11
Beta, Universal Four (SG, D, LF, Cl. B)	15.4.33	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	6.1.34	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's Superformer (SG, SG, D, Pen)	12.10.35	PW57

Mains Operated.

Two-Valve : Blueprints, 1s. each.

A.C. Twin (D (pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Power)	7.10.33	PW31
Selectone A.C. Radiogram Two (D, Pow.)	—	PW19

Three-valve : Blueprints, 1s. each.

Double-Diode-Triode Three (HF Pen, D.D.T., Pen)	10.6.33	PW23
D.C. Ace (SG, D, Pen)	15.7.33	PW25
A.C. Three (SG, D, Pen)	10.9.33	PW29
A.C. Leader (HF Pen, D, Power)	7.4.34	PW35C
D.C. Premier (HF Pen, D, Pen)	31.3.34	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	18.8.34	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"Allwave" A.C. Three (D, 2LF (R.C.))	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	31.8.35	PW56

Four-valve : Blueprints, 1s. each.

A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	9.2.35	PW47

SUPERHETS.

Battery Sets : Blueprints, 1s. each.

£5 Superhet (Three valve)	—	PW40
F. J. Camm's 2-valve superhet (two valve)	13.7.35	PW52
F. J. Camm's £4 Superhet 4	16.11.35	PW58
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (three valve)	—	PW43
D.C. £5 Superhet (three valve)	1.12.34	PW42
Universal £5 Superhet (three valve)	—	PW44
F. J. Camm's A.C. £4 Superhet 4	7.12.35	PW59
F. J. Camm's Universal £4 Superhet 4	11.1.36	PW60

SHORT-WAVE SETS.

Two-valve : Blueprints, 1s. each.

Midget Short-wave Two (D, Pen)	15.9.34	PW38A
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Power)	23.9.33	PW30A
The Perfect 3 (D, 2 LF, RC and Trans.)	8.2.36	PW63

PORTABLES.

Four-valve : Blueprints 1s. each.

Featherweight Portable Four (SG, D, LF, Cl. B)	—	PW12
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MISCELLANEOUS.

S.W. Converter-Adapter (1 valve) 23.2.35 PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE CRYSTAL SETS.

Blueprints, 6d. each.

Four-station Crystal Set	—	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450

STRAIGHT SETS. Battery Operated.

One-valve : Blueprints, 1s. each.

B.B.C. Special One-valver	—	AW387
Twenty-station Loud-speaker One-valver (Class B)	—	AW449

Two-valve : Blueprints, 1s. each.

Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG, Det, Pen)	—	AW392
Iron-core Two (D, Trans)	—	AW395
Iron-core Two (D, Q.P.P.)	12.8.33	AW396
B.B.C. National Two with Lucerne Coll (D, Trans)	—	AW377A
Big-power Melody Two with Lucerne Coll (SG, Trans)	—	AW388A
Lucerne Minor (D, Pen)	—	AW426

Three-valve : Blueprints, 1s. each.

Class-B Three (D, Trans, Class B)	22.4.33	AW386
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394
Home-Built Coil Three (SG, D, Trans)	—	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher: Chassis Model (SG, D, Pen)	—	AW419
Lucerne Ranger (SG, D, Trans)	—	AW422
Cosior Melody Maker with Lucerne Coils	—	AW423
P.W.H. Mascot with Lucerne Coils (D, RC, Trans)	—	AW337A
Mullard Master Three with Lucerne Coils	—	AW424
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All Britain Three (HF Pen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.11.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
£6 6s. Radiogram (D, RC, Trans)	—	WM318
Simple tune Three (SG, D, Pen)	June '33	WM327
Economy-pentode Three (SG, D, Pen)	Oct. '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	Mar. '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	June '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
Graduating to a Low-frequency Stage (D, 2LF)	—	WM378
P.T.P. Three (Pen, D, Pen)	June '35	WM389
Certainty Three (SG, D, Pen)	Sept. '35	WM393
Minitube Three (SG, D, Trans)	Oct. '35	WM396
All-wave Winning Three (SG, D, Pen)	Dec. '35	WM400

Four-valve : Blueprints, 1s. 6d. each.

65/- Four (SG, D, RC, Trans)	—	AW370
"A.W." Ideal four (2SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2SG, D, Pen)	—	AW421
Crusaders' A.V.C. 4 (2HF, D, QP21)	18.8.34	AW445
(Pentode and Class-B Outputs for above: blueprints 6d. each)	25.8.34	AW445A
Self-contained Four (SG, D, LF, Class B)	Aug. '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2LF)	Feb. '35	WM381
The H.K. Four	Mar. '35	WM384

Five-valve : Blueprints, 1s. 6d. each.

Super-quality Five (2HF, D, RC, Trans)	May '33	WM320
New Class-B Five (2SG, D, LF, Class B)	Nov. '33	WM340
Class-B Quadradynic (2SG, D, LF, Class B)	Dec. '33	WM344
1935 Super Five (Battery Superhet)	—	WM379

These blueprints are full size. Copies of appropriate issues containing descriptions of these sets can in most cases be obtained as follows:—
 "Practical Wireless" at 4d., "Amateur Wireless" at 4d., "Practical Mechanics" at 7d., and "Wireless Magazine" at 1/3d., post paid. Index letters "P.W." refer to "Practical Wireless" sets, "P.M." to "Practical Mechanics" sets, "A.W." refer to "Amateur Wireless" sets, and "W.M." refer to "Wireless Magazine" sets. Send (preferably) a postal order (stamps over sixpence unacceptable) to "Practical and Amateur Wireless" Blueprint Dept., Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

Mains Operated.

Two-valve : Blueprints, 1s. each.

Consoelectric Two (D, Pen) A.C.	23.9.33	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C./D.C. Two (D, Pen)	Sept. '35	WM394
Three-valve : Blueprints, 1s. each.		
Home-lover's New All-electric Three (SG, D, Trans) A.C.	—	AW383
S.G. Three (SG, D, Pen) A.C.	—	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW390
A.C. Pentaquester (HF, Pen, D, Pen) A.C.	23.6.34	AW439
Mantovani A.C. Three (HF, Pen, D, Pen) A.C.	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	Jan. '36	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen)	July '33	WM329
Harris Jubilee Radiogram	May '35	WM386

SUPERHETS.

Battery Sets : Blueprints, 1s. 6d. each.

Modern Super Senior	—	WM375
Varsity Four	Oct. '35	WM395
Mains Sets : Blueprints, 1s. 6d. each.		
1934 A.C. Century Super A.C.	10.3.34	AW425
Heptode Super Three, A.C.	May '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
1935 A.C. Stenode	Apr. '35	WM385

PORTABLES.

Four-valve : Blueprints, 1s. 6d. each.

Midget Class-B Portable (SG, D, LF, Class B)	20.5.33	AW638
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Two H.F. Portable (2 SG, D, QP21)	June '34	WM363
Tyers Portable (SG, D, 2 Trans)	Aug. '34	WM367

SHORT-WAVERS—Battery Operated.

One-valve : Blueprints, 1s. each.

S.W. One-valve converter (price 6d.)	—	AW329
S.W. One-valve for America	—	AW429
Roma Short-waver	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-short Battery Two (SGdet, Pen)	Feb. '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-waver	Jan. 19, '35	AW463
The Carrier Short-waver	July '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World Beater (HF Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valve Short-waver	Mar. '35	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-wave Super	Nov. '35	WM397

Mains Operated.

Two-valve : Blueprints, 1s. each.

Two-valve Mains Short-waver (D, Pen) A.C.	—	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	Aug. '34	WM368
"W.M." Long-wave Converter	—	WM380
Three-valve : Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	Aug. '35	WM391

MISCELLANEOUS.

Enthusiast's Power Amplifier (1/6)	June '35	WM387
Listener's 5-watt A.C. Amplifier (1/6)	Sept. '35	WM392
Radio Unit (2v.) for WM392 (1s.)	Nov. '35	WM393
Harris Electrogram (battery amplifier)	Dec. '35	WM399
De-Luxe Concert A.C. Electrogram	Mar. '36	WM403
New style Short-wave Adapter (1s.)	June '35	WM388
Trickle Charger (6d.)	Jan. 5, '35	AW462
Short-wave Adapter	Dec. 1, '34	AW456
Superhet Converter	Dec. 1, '34	AW457

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ACHL, ACL, SG. Variable Mu. 1, 3 and 4-watt directly heated Output Pens. H.F. Pen. Variable Mu H.F. Pen. 250 volt 60 ma. Full-wave Rectifiers. All 4/6 each. 20 volt 18 amp. AC/DC types. Screen Grid. Variable Mu. H. HL. Power. Pen. All 4/6 each. 350 volt 120 m.a. Full Wave Rectifiers. 500 volt 120 m.a. Full Wave Rectifiers. 2½ watt indirectly heated Pens. 2½ w. directly heated Power. All 5/6 each. 2-volt Battery types, H.F., L.F., 2/3. Power. Low Consumption Power. Super Power, 2/9. Screen Grid. Variable Mu 4- or 5-pin Pens. Variable Mu., H.F. Pen. H.F. Pen. All 5/- each. Class B Valves, 3/6.

American Types: 250, 210, 245, 47, 46, 24, 35, 37, 51, 55, 57, 58, 80, 6A7, 2A7, 2A5, 27, 77, 78, 281. All 4/6 each. All the following super quality American types. Hytron Brand, 5/6 each: 1A6, 1C6, 2A5, 2A6, 2A7, 2B7, 6A4, 6A7, 6B7, 6C6, 6F7, 12A5, 19, 24A, 26, 27, 30, 31, 32, 33, 34, 35/51, 36, 37, 38, 39/44, 41, 42, 43, 45, 46, 47, 49, 6D6, 53, 55, 56, 57, 58, 59, 75, 76, 77, 78, 79, 85, 89, 6A6, 83, 5Z3, 25Z5, 12Z3, 1V.

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Premier Short Wave Tuning condensers (S.L.F.), complete Ceramic Insulation. Silver Sprayed Brass Vanes. Noiseless Pigtail 0.00016, 0.0001, 2/9 each. Double-spaced, 0.00005, 0.000015, 0.000025, 3/- each. Premier all-brass Short Wave condensers, 0.00015 with integral slow motion, 3/9. British Radiophones, all brass, 2-gang short wave condensers, 0.00015, each section, 5/6 each. Ormond, 0.00025, O.K. for Short Waves, marvelous value, 1/6 each. With slow motion, 2/- each. Ormond, 0.00025, slow motion condensers, all brass, super value, 2/6. Ormond, 0.00025 with special Logging Dial, ideal for band setting, 2/- each. Short Wave Reaction Condensers, all brass, integral Slow Motion, 0.00015, 2/9 each.

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Premier Super Short Wave Coils, with circuit, 4- and 6-pin type, 13-170 metres. Set at 4, either type, 7/-.

Premier Low Loss, 4- and 6-pin ribbed formers, 1½ diameter, finest quality, 1/- each.

Please note that only the very highest grade Plastic material is used in the manufacture of Premier Short Wave Coils and Formers.

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Reliable Short Wave Coils, 4-pin type, 14-150 metres with circuit, 4/- set of 3. Stand-off insulators, 1" 2½d., 1½" 3d., 2" 4½d., 4" 9d.

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Lissen 3-gang Band Pass Screened Coils, complete with switching and blueprint, 6/11. Lissen All-wave 2-gang Screened Coils for Screened Grid Tuned H.F. stage; and Detector, 12 to 2,000 metres. Complete circuit diagram supplied, 12/6. Selective Iron Cored Coils with circuit, 2/11 each. Varley Band Pass Aerial Coils, B.P.7, 2/9.

Special Offer. Set of three Lissen Band Pass Screened Coils with Switching. Utility 3-gang Condenser and Illuminated Disc Drive, 4-valve Chassis and Valve holders and blueprint, 14/8 the lot.

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Coscor 8" Permanent Magnet Speakers, 13/6. Reliable Permanent Magnet Speakers, 10/6. Moving Coil Speakers, all fitted output transformers. Magnavox 254, 7" diameter, 16/6. Magnavox 252, 9" diameter, 22/6. Blue Spot 29 PM 8" diameter, 15/-; without transformer, 12/6. Energised Moving Coil Speakers, all fitted output transformers (unsuitable for battery sets). Kolster Brandes, 7" diameter, 1,500 or 2,500 ohm fields, 7/9. W.B., 8" diameter, 2,500 ohm field, 9/11. Magnavox DC 154, 7" diameter, 2,500 ohm field, 4 watt, 12/6. Magnavox DC 152 Magna, 9" diameter, 2,500 ohm field, 6 watts, 37/6. B.T.H., 8" diameter, 1,500 or 7,500 ohm fields, 8/6. AC Energised Units for any of the above Speakers, 10/-. Magnavox 6v. Field Model, 6 watts, 12/6. Magnavox, 9" 152, 2,500 ohm, 17/6. Magnavox Magna D.C. 154, 2,500 ohm field, 5 watt, 25/-.

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Premier Mains Transformers have tapped Primaries, and C.T., L.T.'s Engraved Panels, with N.P. Terminals. All windings paper interleaved. Combined H.T.8 and H.T.9, 4v. 1-2a, and 4v. 3-4a., 10/-.

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Universal mains, A.C. or D.C., with moving-coil speaker. 1936 model.

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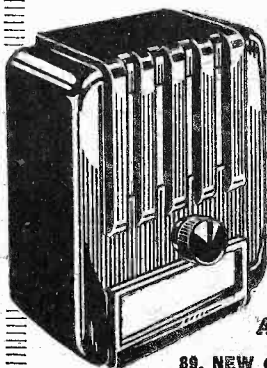
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- 17/6 DITTO. With H.T.S. Metal Rectifier.

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

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- 2/11 BRITISH RADIOPHONE 3 GANG SUPERHET CONDENSERS. With 110 kc/s Oscillator Section, unscreened. Wonderful bargain.
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(Continued at top of column two)

(Continued from foot of column one)

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- 1/- 4 mfd. POST OFFICE TYPE MAINSBRIDGE CONDENSERS. 250 volt working.
- 6d. DRILLED METAL CHASSIS. 3 Valve type.
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- 1/3 G.E.C. 500,000 ohms VOLUME CONTROLS. With Switch.
- 1/11 G.E.C. MANUFACTURERS TYPE L.F. TRANSFORMERS.
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- DEMARK Short-wave Adaptor Kit, complete with all accessories for adapting set to 14-150 metres, 20/-; superhet short-wave converter kit, 20/-.
- G.E.C. A.C. D.C. Mains 3-valve Sets, complete with 3 Osram valves in exquisite Bakelite cabinet, with Osram M.C. speaker, ready to plug in to any mains universal voltage, new, in sealed cartons, fully guaranteed; £319/6 (list £7/15).
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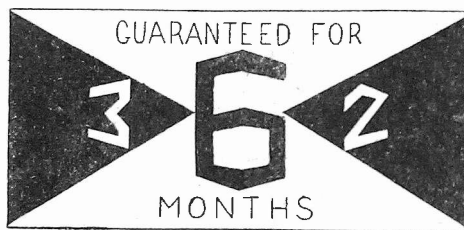
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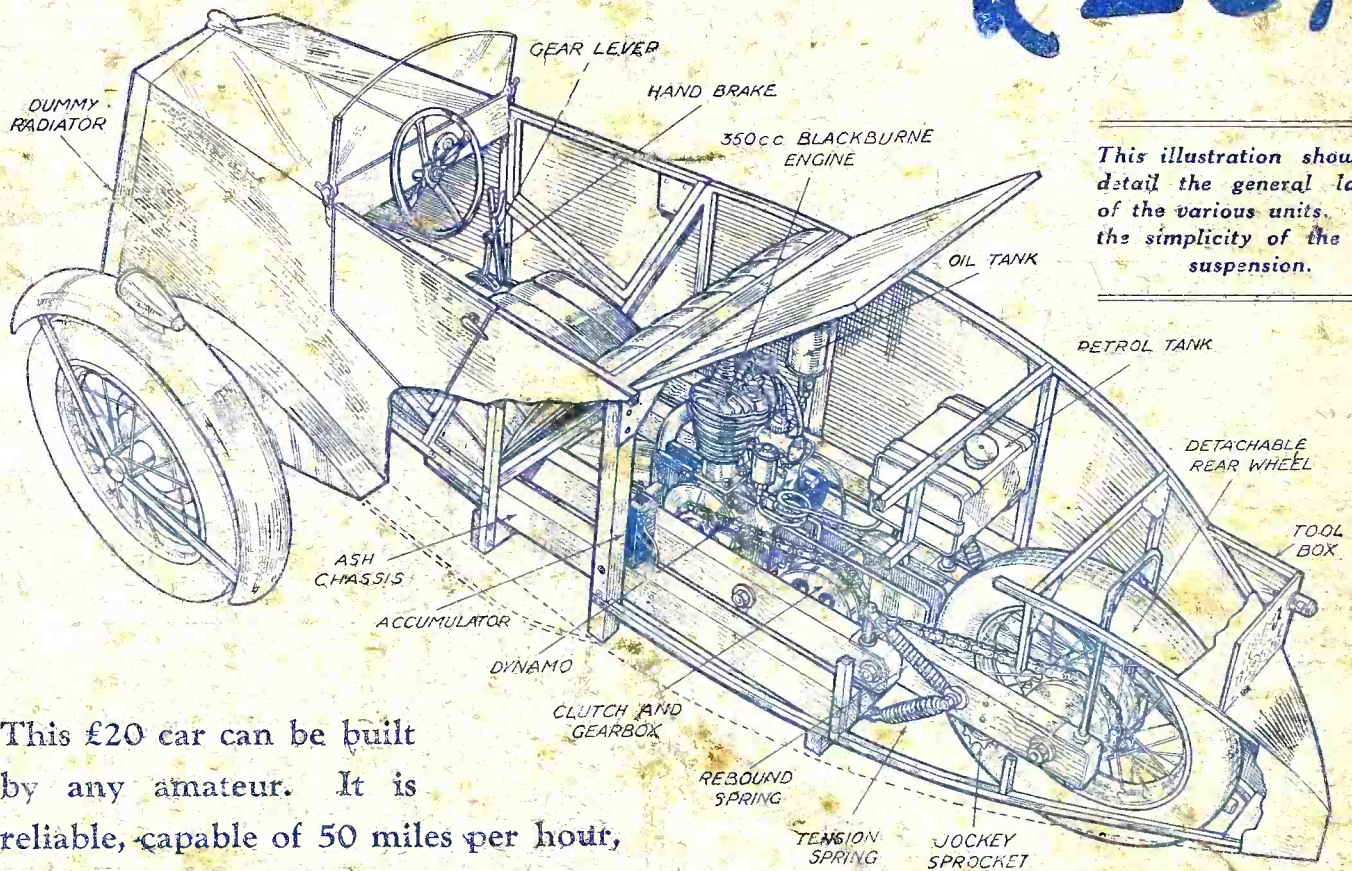
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