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Practical Wireless

3D.

AND AMATEUR TELEVISION

EDITED BY F. J. CAMM.

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Adjusting & Testing Tuning Coils

THE LEADING WIRELESS WEEKLY!

Practical Wireless

EDITOR:
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Frank Preston, F.R.A.

ROUND *the* WORLD *of* WIRELESS

Next Week's Big Event!

THE most important event in the history of radio journalism will coincide with the publication of next week's big 64-page issue (same price, 3d.), for not only will it present a FREE FULL-SIZE BLUEPRINT of our new Quality Receiver—The A.C. Hall-mark—it will also contain an announcement of the greatest importance to every constructor, every amateur, every experimenter—in fact, to every listener in the country.

The importance of the great event forming the subject of next week's special announcement cannot be overemphasised, for every reader will benefit as a result of the policy which next week's issue introduces. "Practical Wireless" has held a distinguished and leading position in radio journalism from its very commencement. It has been responsible for many ingenious features, gifts, and designs, and for a greatly increased interest in home construction. We are not over-optimistic when we state that by the development which next week's issue portends, we shall make another gigantic stride forward and considerably enhance the esteem in which the paper is held by its many thousands of readers in all parts of the world.

For details of this far-reaching development order next week's Big 64-Page issue now!

TWO JOURNALS FOR THE PRICE OF ONE—3d.!

An Elgar Concert

AN Elgar Concert will be relayed from St. John's Hall, Penzance, for West Regional listeners on January 25th, when the artists will be Trefor Jones (tenor) and the Mousehole Male Voice Choir, conducted by Leonard Collins.

The Hallé Orchestra

THE HALLÉ Chorus and Orchestra, conducted by Dr. Malcolm Sargent, are to broadcast Bach's "Mass in B minor" to North Regional listeners from the Free Trade Hall, Manchester, on January 24th. The soloists will be Norah Sinclair (soprano), Sara Buckley (contralto) and Norman Walker (baritone).

ORDER NEXT WEEK'S BIG 64-PAGE ISSUE NOW!

SAME PRICE — 3d.

FREE BLUEPRINT
of F. J. Camm's
Strikingly Efficient
A.C. HALL-MARK
Quality Receiver
employing Push-pull Output

A Broadcast Pleasure Cruise

THE first of a new series of programmes for Welsh listeners will be given on January 23rd. This series will take the form of a pleasure cruise round the coast of Wales; there will be passengers and a guide on board, and they will stop at interesting spots which will be pointed out by the guide. Stirring incidents of the past will be described to listeners, including romances of castles and cottages, of ports and villages, and of cathedrals and rivers.

Midland Parliament

THE question to be discussed at the third session of "Midland Parliament" on January 21st is that of responsibility for welfare, or, in other words, what should the State expect the employer to do for his employees besides paying them? Sir Charles Mander, of Wolverhampton, will again act as Chairman, and Lord Trent, whose welfare schemes make special provision for the training of girl workers, many of whom leave to get married, will be one of the speakers. Frank Hodges will also represent the side of the employers; while George Jones, Secretary of the Midland Miners' Federation, and Isaac George, who is employed in a Birmingham motor works, will speak from the workers' angle.

Broadcast Artists from Australia

TWO Australian artists are to provide the Manchester Tuesday Midday Society's Concert, which will be broadcast to the North Region from the Houldsworth Hall on January 22nd. They are Emelie Hooke, soprano, who was originally trained as a pianist at the Melbourne Conservatoire and who has since done much choral, oratorio, concert, and operatic work; and Eileen Ralph, pianist from Perth, Western Australia, but who, winning an Associated Board Exhibition, completed her musical studies at the Royal Academy of Music in London.

Liverpool Philharmonic Orchestra

UNDER the direction of Carl Schuricht, famous German conductor, the Liverpool Philharmonic Orchestra will broadcast a concert to North Regional listeners from the Central Hall, Liverpool, on January 22nd. The programme is to include Bach's "Brandenburg Concerto, No. 4 in G," and the Brahms "Concerto in A minor for violin, 'cello and orchestra" (soloists, Orrea Pernel and Antonia Butler).

New Children's Hour Feature

A NEW feature will commence in the Children's Hour on January 22nd. Uncle Mac has arranged for talks to be relayed from the capitals of Europe. These talks will not be recorded or broadcast from our studios, but are actually coming from the towns which they describe. The children will hear André Cheramy talking from Paris, and describing for London children the beauty and charm of his city.

ROUND the WORLD of WIRELESS (Continued)

O. Knine Reception — Without Comment!

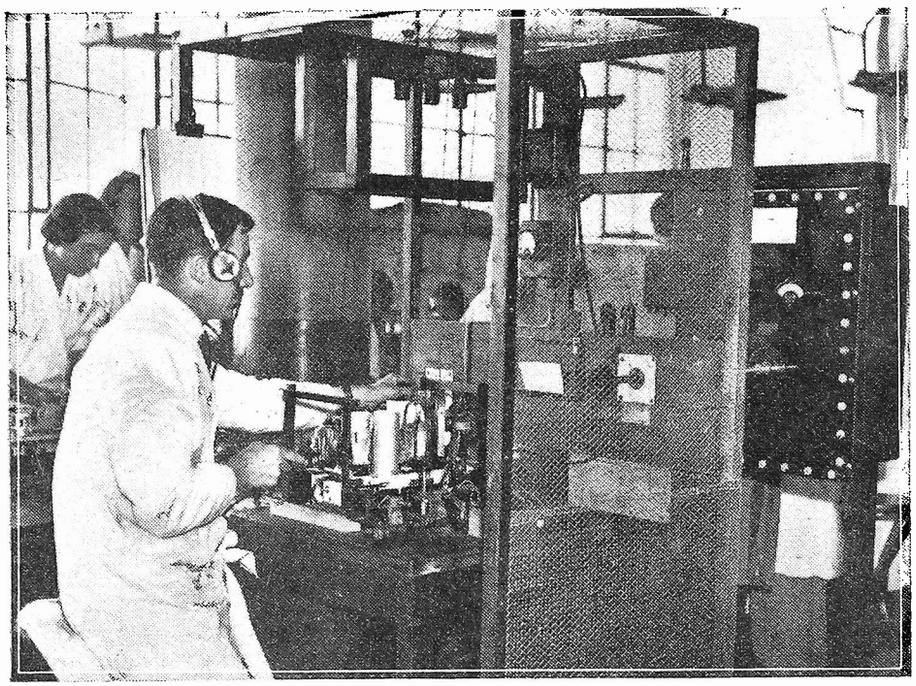
ACCORDING to a recent report from America a Los Angeles experimenter is esponsible for a novel method of reception. He attaches an aerial to the collar of his Great Dane and clips an ear 'phone to the animal's tail. The canine radio is then complete, and all that is necessary is to place the 'phone to the ear and listen.

INTERESTING and TOPICAL PARAGRAPHS

Orchestral Concert from Birmingham

THE Birmingham Theatre Royal Orchestra will broadcast for the first time to Midland Regional listeners on January 20th. Sheridan Gordon, the conductor, came to Birmingham last year to re-organise and take charge of the orchestra.

TRANSMITTERS FOR TESTING RECEIVERS



This illustration shows one of the miniature transmitting stations which have been established in the H.M.V. factories to test the sensitivity and selectivity of receiver chassis, and to ensure that they are free from spurious interference. A modulated H.F. signal is applied to the terminals of the receiver and the output is measured on a meter.

Variety from Blackpool

ON January 18th an excerpt from a variety bill will be relayed to North Regional listeners from the Palace Theatre, Blackpool.

Hallé Orchestra

NIKOLAI MALKO, conductor of the Leningrad Philharmonic Orchestra, is to direct the Hallé Orchestra in a concert which will be relayed to North Regional listeners from the Free Trade Hall, Manchester, on January 17th. The programme includes, appropriately, two Russian compositions—the "Capriccio Espagnole" of Rimsky-Korsakov, and Glazounov's "Concerto for solo violin and Orchestra in A minor" (soloist Henry Holst), in addition to Beethoven's "Symphony No. 7 in A major."

"Jack and the Beanstalk"

IT will be recalled that, a few days after the sudden death of Julian Wylie, an extract from a rehearsal of his Birmingham pantomime, "Jack and the Beanstalk" was broadcast. On January 26th Midland Regional listeners will hear relays of scenes from this pantomime from the stage of the Theatre Royal, Birmingham. The cast includes Dorothy Ward, Shaun Glenville, Albert Burdon, Marjorie Wyn and Wallace Lupino.

"Toy Town"

THAT famous city "Toy Town" is again in the news on January 29th, for the citizens of Toy Town are to give their own programme. This Toy Town is becoming very famous. Many children enjoyed the Toy Town pantomime at Christmas, and will be delighted to meet again many of the famous Toy Town characters.

"Snowdrop and the Seven Dwarfs"

ON January 22nd, Ronald Hill's amusing Hollywood version of the fairy tale, "Snowdrop and the Seven Dwarfs" is to be given in the Midland Regional programme. This was one of Martyn Webster's successes of last year. Hugh Morton and Alma Vane are in the cast; Jack Wilson conducts the Midland Revue Orchestra, and the singers include "Those Three" from Nottingham.

"Love Needs a Waltz"

A VOICE new to radio will be heard in "Love Needs a Waltz," which Charles Brewer is producing on January 29th. Anne Ziegler is making a film of "Faust" and her voice on the set appeared so suitable for broadcasting that she was invited to give an audition. Charle Brewer is very optimistic as to her suitability. This musical play was broadcast earlier in the year, but the producer has made many cuts and alterations which will add to the speed and continuity of this musical story.

"Charlot's Hour" and "Picture People"

INTERESTING January broadcasts will be "Charlot's Hour" on the 22nd and 23rd, and "Picture People" on January 22nd. The latter is a compilation of film sound tracks co-ordinated by Clayton Hutton who, listeners may remember, introduced to radio many of the world's greatest film stars singing the songs they made famous. It is an interesting way of broadcasting the greatest film song-hits sung by the actual stars themselves. Listeners will be able to compare this programme with John Watt's "Songs from the Films" on January 28th when famous film song hits will be sung by radio stars.

Symphony Concert from Birmingham

ON January 24th, Midland Regional listeners will hear a relay of part of the symphony concert by the City of Birmingham Orchestra, from the Town Hall, Birmingham. Sir Thomas Beecham is to conduct the second Sibelius symphony.

In Memory of Jenny Lind

A RELAY will be taken for West Regional listeners from a concert to the memory of Jenny Lind at the Reardon Smith Lecture Theatre of the National Museum of Wales on January 22nd. Among the artists will be Mavis Bennett-Levin, who has made a special study of the history, tradition and musical associations of Jenny Lind.

SOLVE THIS!

PROBLEM No. 122.

Bond constructed a receiver having push-pull output, two pentodes of 11,000 ohms optimum load being used in the output stage. The moving-coil speaker had a speech coil with 5 ohms impedance, and he therefore calculated (from the usual formula) that the output transformer should have a ratio of approximately 45 to 1. When this ratio was used, however, results were far from satisfactory, and it was found that volume and reproduction were improved by using a ratio far in excess of this. Where had he gone wrong? Three books will be awarded for the first three correct solutions opened. Mark your envelopes Problem No. 122 and address them to: The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Entries must be received not later than first post on Monday, January 21st.

Solution to Problem No. 121.

In ordering the mains transformer Carslake had overlooked the fact that since the voltage was being stepped up, the input current to the rectifier should be in excess of the rated output. Thus the transformer used should have been designed to give approximately 100 milliamps. This point would have been noticed if he had carefully noted the recommendations given by the makers of the rectifier.

The following three readers have correctly solved Problem No. 120 and books are being sent to them: J. R. Brannigan, 23, The Crescent, Salford, Lancs.; C. T. Barnes, 1, Elmer Street North, Grantham, Lincs.; R. J. Dacken, c/o 30, Elew Road, Altrincham.

ADJUSTING & TESTING TUNING COILS

A Brief Analysis of the Faults which are Likely to be Found in Tuning Coils, with a Description of the Tests to be Applied

By THE TECHNICAL STAFF

MODERN coils are so efficient and generally free from faults that an article under the above heading might scarcely seem to be justified. But the queries received by us from a large number of readers indicate that, as a rule, coils are by no means well-understood, and that the average novice in home construction is at a loss to know how to carry out proper tests when the coils come under suspicion. Let it be pointed out right away that a large number of the minor difficulties which do present themselves in connection with tuners and coil assemblies are due to unsympathetic treatment of them. As an example of this it should be explained that, of a large number of readers' coils which have been examined in our laboratories at various times, most of these have been damaged by attempting to over-tighten the terminals, with a result that these have been turned round bodily and the thin leads to them from the windings have thereby been broken.

Do Not Over-tighten Terminals

It has been pointed out in these pages on more than one occasion that it is unnecessary to make the terminals more than finger tight, but this warning has not always been observed. As regular readers are aware, we are strongly in favour of soldering connections wherever possible, and if coil connections (and those to most other components for that matter) were made by soldering the leads to small soldering tags fitted under the terminal nuts many difficulties would at once vanish. Perhaps makers are in some measure responsible, due to the fact that many of them do not supply the necessary tags with their components, but it need hardly be mentioned that neat and useful soldering tags can be bought for a few coppers per hundred.

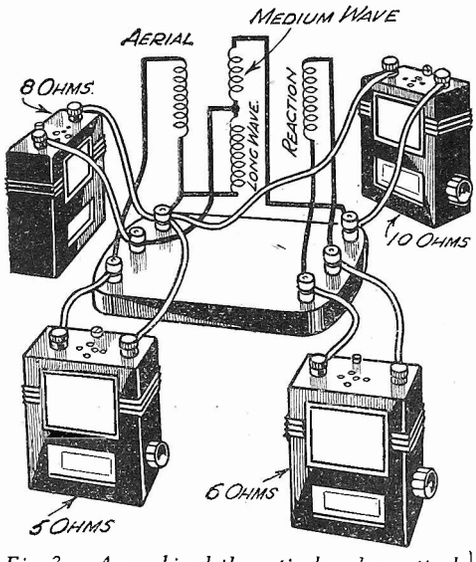


Fig. 3.—A combined theoretical and practical diagram showing the points between which a dual-range tuner with loose-coupled aerial winding should be tested with an ohm-meter, and the (very approximate) reading to be expected.

A very common reason for coil terminals being loosened is that thin connecting wire, or even stranded flex, is used for making connections; this is very liable to lock the nut on the thread of the terminal shank, as shown in Fig. 1, so that when an attempt is made to screw the nut right down the whole terminal must work loose.

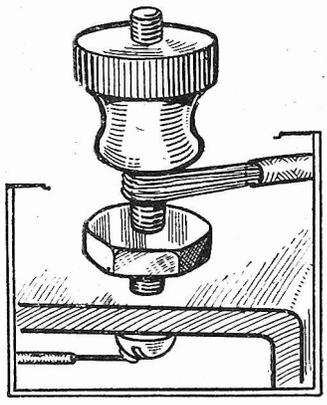


Fig. 1.—Coil terminals are often loosened by using stranded flex for making connections. A thin strand locks the nut on the threads so that when the nut is tightened the whole terminal is rotated.

Short-circuited Terminals

Even if the lead from the winding to the terminal does not break, there is another difficulty that might present itself in the case of coils the terminals of which are mounted on a pressed metal baseplate fitted with insulating washers or bushes. When the terminal is loosened the washers come apart and allow the terminal to slip out of position and thus make contact with the metal base. As the earth terminal is generally connected to the base, one of the windings will be short-circuited. If it is the tuning winding that is affected, there will be an absence of signals on either one or both wavebands, but if the reaction coil is shorted it is possible that the H.T. supply might be short-circuited, with serious results. A few instances have been noted where the valve-filaments have been burnt out due to this. The reason is illustrated in Fig. 2, where it will be seen that the on-off switch is in the combined H.T. negative-L.T. negative lead, this lead being joined to the earth terminal. When H.T.+ is inadvertently connected to earth due to the coil short the voltage applied to the filaments is equal to that of the H.T. tapping used to feed the detector and of the accumulator in series.

It will be clear from what has been said that, if a coil terminal is loose, it is very important that a careful examination should be made and the looseness corrected. If the lead to the terminal from the winding appears to be badly twisted the wire should be scraped clean and re-soldered.

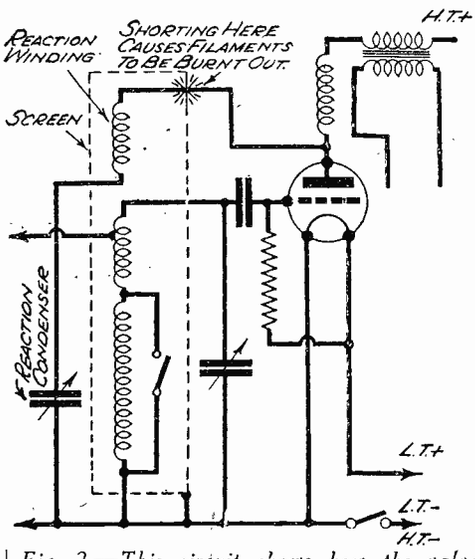


Fig. 2.—This circuit shows how the valve filaments might be burnt out due to one terminal of the reaction winding shorting to the coil screen or base plates.

Measuring the Resistance of the Windings

Really accurate and scientific tests of tuning coils cannot be made by using the limited amount of apparatus usually possessed by the average constructor, but it is generally sufficient to take readings of the D.C. resistance of the various windings, when any break, faulty operation of the wave-change switch, or bad terminal connection can be traced. An ohm-meter is required for taking these measurements, and an instrument such as the "Pifco" Rotameter, "Avo-Minor" or "Avometer" is ideal. If the terminals of the meter are connected between the grid and earth terminals of the coil, readings of approximately 2 ohms and 10 ohms should be obtained when the wave-change switch is in the medium- and long-wave positions respectively. These readings will not necessarily be obtained, and the figures will vary to a certain extent according to

(*Continued overleaf*)

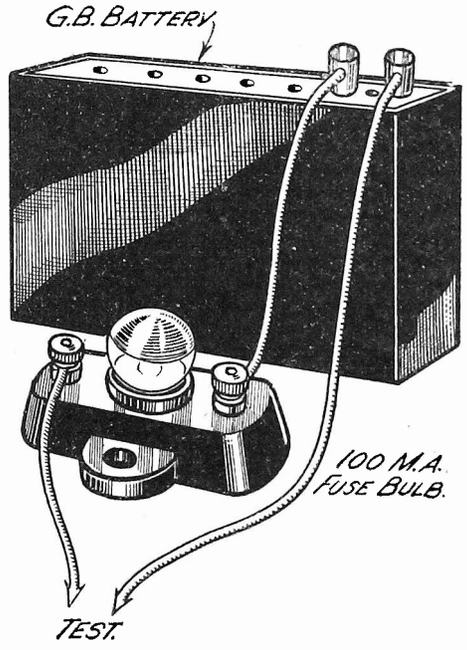


Fig. 4.—Showing a very simple arrangement for checking coil windings.

(*Continued from previous page*)

the particular make of coil being tested, but the ratio between the two readings should be about 5 to 1. So long as one reading is appreciably greater than the other, however, the exact figures may be ignored. When a pair of similar coils are employed in the same receiver the D.C. resistance of the windings of both should be the same; if not, it will be a fair indication that the coils are not matched, or that one of them is faulty.

In addition to testing the tuned windings of the coil, the reaction winding should also be tested for continuity by placing the ohm-meter across its terminals. The resistance of this winding will probably be found to be equal to about half that of the long-wave tuned winding, but provided that there is continuity the resistance value need not generally be considered. Fig. 3 shows the various points to which the meter should be connected, and gives a rough indication of the readings which one might expect to obtain.

A Simpler Test

When an ohm-meter is not available it is possible to make a suitable instrument by means of a milliammeter and various shunt and series resistances, as described in PRACTICAL WIRELESS dated December 30th, 1933. Alternatively, the resistance measurements may be taken by means of a home-made "bridge," such as that described in PRACTICAL WIRELESS dated October 14th, 1933. Quite a simple and fairly reliable test can, however, be made as shown in Fig. 4, simply by using a 100-m.a. fuse bulb and a grid-bias battery. First of all, the positive and 1½-volt negative battery tappings should be used and the two "test" leads connected to the two ends of the coil, as explained before. When the switch is in the medium-wave position it should be found that the bulb glows, but the light should not be so bright as when the two "test" leads are joined together; if it is, the windings, or connections from them, must be short-circuited. If the wave-change switch is turned to the long-wave position the light should either go out completely or become extremely dim. If the light does go right out, increase the voltage of the G.B. battery in 1½-volt steps until the light returns. If the bulb glows when the switch is in the medium-wave position, and cannot be made to do so on long waves, it is a clear indication that the long-wave winding is either disconnected from the terminal or broken at some point. The leads to the terminals can be traced, and if these are in order, examination should be made at those parts of the winding where the wire passes from one slot to the next. If the wire has been broken or fractured at one of these places it will probably be necessary to remove a portion of the winding until the ends of the break can be scraped clean and soldered together again.

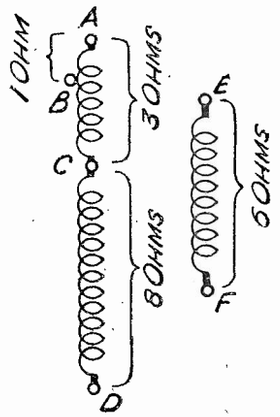


Fig. 5.—The diagram illustrates the method described in the text for tracing the connections of a typical coil.

Should it be found that the resistance is just the same regardless of the position of the wave-change switch, it will generally be found that the switch itself is at fault. Should the resistance remain low (equal to that of the medium-wave section only), the switch contacts are probably failing to "open." On the other hand, if the resistance remains high, the contacts are not "closing" properly, perhaps due to one of the contacts being strained or because it is dirty. The method of effecting a remedy naturally depends upon the type of switch employed, but once the fault has been traced, the cure will generally be fairly obvious.

Tracing Coil Connections

It sometimes happens that the constructor has a coil for which the connections are not known. When this is the case it is generally a fairly simple matter to trace out the terminals by applying the tests described above in the "reverse direction," as it were. That is, measurements must be taken between various terminals. For example, if it were found that a resistance of, say, 3 ohms occurred between two particular terminals, whilst the resistance between one of these terminals and a third was 8 ohms, the resistance between the other pair being 11 ohms, it would be evident that the first two terminals were those joined to the ends of the medium-wave winding, and that the second two terminals tested were joined to the ends of the long-wave winding. In other words, the tuning condenser would have to be connected between the terminals from which the 11-ohm reading was obtained, the wave-change switch being wired between those terminals between which a resistance of 8 ohms was measured.

This will perhaps be understood more clearly by making reference to Fig. 5, which shows the circuit of a typical coil with the terminals lettered from A to F, and with the resistance readings just mentioned indicated. After locating the tuned winding, the next step would be to find the tapping marked B; this could be done by connecting one side of the meter to terminal A and moving the other lead about until a resistance of about 1 ohm was obtained. The reaction winding could be located by finding—by means of the meter—two terminals which were connected together, but which were not in connection with the tuned winding. In some cases, however, the lower end of the reaction coil (terminal F) would be joined to terminal C, when a reading would be obtained between terminal E and every other terminal on the coil. The reaction terminals would easily be located, however, due to the fact that the terminal showing the least resistance from terminal E would be joined to the other end of the reaction winding.

The tests just described could be carried out fairly satisfactorily by means of a fuse bulb and battery, as explained before, but the process would be somewhat more laborious and slow.

PROGRAMME NOTES

"The Babes in the Wood"

ON January 26th, excerpts from "The Babes in the Wood," a pantomime projected by the late Julian Wylie, will be broadcast to North Regional listeners from the Theatre Royal, Newcastle. The conception is essentially Wylie's, although his place as impresario and producer has been taken by Herbert Bryan and Arthur Rigby. The cast includes G. S. Melvin, Nancy Fraser, Geraldine and Joe de Haven and Page, Frances Seymour, Jack Morrison, Gene Durham, Valerie Larg, Walter Brown, Kirby's Flying Ballet, the Twelve Eileen Regan Girls, the Julian Wylie Chorus and his Ballet of twenty-four children.

"Tammie Shanter"

SOME excerpts from the fifty-fifth Royal Princess's pantomime "Tammie Shanter" now running in the Royal Princess's Theatre, Glasgow, will be relayed on January 22nd. The cast of this pantomime, which has been produced by Harry McKelvie, includes Kitty Franklyn, Maia Barrie, Herbert Evelyn, John Traynor, Jack Raymond, Nora Harrington, Frank Richards, Billy Norton, Edith Thomson, Minnie Thomson, Sylvia Watt, George West, Ernie and Gene, with Robert McLeod as musical director. Later the same evening the last act will be broadcast and listeners will hear the thunders of applause that greet the final fall of the curtain.

Variety from Doncaster

AN excerpt from the variety bill will be broadcast from the Grand Theatre Doncaster, on January 24th, to North Regional listeners.

London-Welsh Curiosities

THIS is the title of a talk by Caradog Prichard in the Welsh Interlude for Droitwich National and West Regional listeners on January 26th.

Colliery Band Concert

THE Black Hall Colliery Band from County Durham, winners of the Northern Counties Amateur Brass Band Contest at Gateshead on December 15th, are to broadcast a concert to North Regional listeners from a Newcastle studio on January 22nd.

Talk on Domestic Animals

"FUR AND FEATHER" is the title of a new series of North Regional talks which starts on January 22nd. The talks will be about the care of domestic animals, such as bantams, canaries, rabbits, and cats. The opening talk, given by a well-known Northern authority, will deal with fancy pigeons.

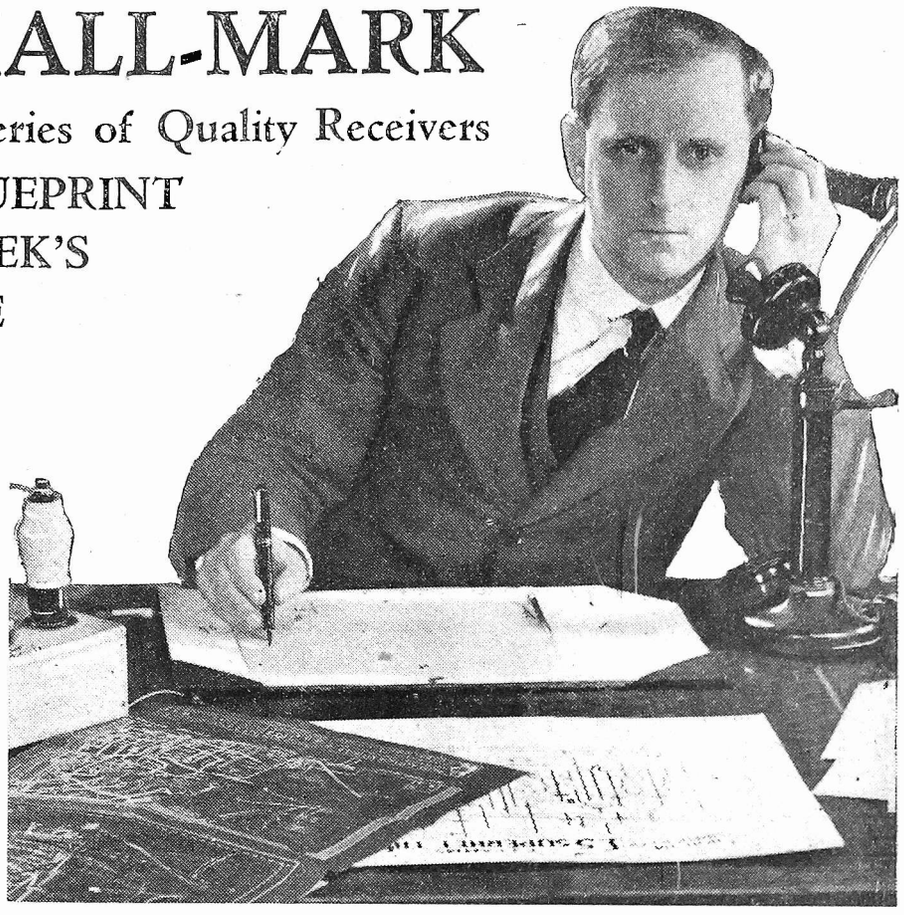
Highest Radio Station in Europe to Transmit News

IT is stated that the Monte Rosa radio station, on the Italian side of the Italo-Swiss frontier, will shortly be used for sending out news bulletins, according to Philips Press Service. Standing on the summit of the Monte Rosa, the transmitter is situated at an altitude of 14,000ft. above sea level. The station maintains telephonic communication with the Observatory Regina Margherita and the Mosso Col d'Olen Institute. The installation comprises a modern ultra short-wave transmitter, with a capacity of one kilowatt.

THE A.C. HALL-MARK

The First of Our New Series of Quality Receivers

FREE FULL-SIZE BLUEPRINT WITH NEXT WEEK'S 64-PAGE ISSUE



THE correspondence pages of PRACTICAL WIRELESS have, during the past three weeks, given an excellent indication that there exists some thousands of readers who do not seek a set with world-circling proclivities, but prefer one whose chief claim is to the quality of its reproduction, combined with reasonable selectivity and the ability to receive a number of British and Continental programmes at exceptional loud-speaker strength. I must confess that I had not thought so large a market existed, for most of my readers, in addition to expressing a desire for the type of receiver broadly outlined above, have also asked that it should have a really hefty undistorted output in the neighbourhood of two watts or more. Now it is a fundamental thing that you cannot receive a maximum number of stations at maximum strength and extreme quality. If you wish to increase selectivity and sensitivity, something must be sacrificed, usually quality.

Quality First

So, with the A.C. Hall-Mark, a FREE BLUEPRINT FOR WHICH WILL BE GIVEN WITH EVERY COPY OF NEXT WEEK'S ISSUE, I started the other way round, namely, by considering quality first, and then carefully considering what I should sacrifice towards that end. In my latest receiver you have what I think will be admitted to be the best possible compromise between the opposing, and in some instances conflicting, interests of selectivity, sensitivity, quality, and punch.

In the first place, I do not think any reader, however touchy he may be on the question of quality, will have the slightest complaint to make on that score concerning the Hall-Mark Three. I think it fair comment to say that there is no commercial receiver, however expensive, which is superior to it. It has a large undistorted output of no less than 2½ watts, provided by a well-tried circuit—including a variable-mu H.F. stage, leaky-grid detection, and push-pull.

Economy Considerations

Whenever one attempts to design a quality receiver, one comes hard against the thorny question of price. As with a motor-car, economy and quality cannot always go hand in hand. If you wish to purchase a commercial receiver with any claim to real quality of reproduction, you have to pay for it—and pay fairly heavily. In spite of this somewhat difficult obstacle, in the A.C. Hall-Mark you will find that I have effected it by judicious selection of components, by the balancing out of inefficiency, by a very careful choice of components, and by arranging these in the most satisfactory manner after careful experiment. The circuit has been so designed that, although it follows closely upon accepted principles, and is so simple that it may be made by the veriest beginner, it is carefully "balanced" throughout. By this means it has been possible to obtain the high degree of quality and the excellent output wattage demanded by all critical listeners to-day at a price that has been reduced to a minimum.

Tuning is sufficiently sharp for most requirements and when extremely long range is not the chief point at issue. Due to the use of highly efficient air-core coils, with loose coupled windings, the degree of selectivity afforded is easily ample for the separation of even the nearer and more powerful stations, and will, by the majority of constructors, be considered to be of an extremely high order. But I think I can say with all modesty that my own standards of selectivity are higher than those of most, and it is for this reason that I do not claim "hair-breadth" tuning or "razor-edge" selectivity for this highly-satisfactory receiver.

Easy Operation

Nicety of control has been carefully considered, with the result that any member of the family can operate the set and obtain perfectly good reception. The reaction control fitted, however, is so smooth in its operation that when additional selectivity is required, or when the user desires to "reach out" there is an ample margin of power. Volume control also is very smooth-acting, due to the provision of a variable-mu potentiometer which gives a well-graded control of loud-speaker output from a whisper right up to the full-bodied reproduction of a brass band. This is assisted by the powerful push-pull output stage which I have mentioned above, and which enables the receiver always to be worked with ample power in hand. To use a motoring metaphor, it is scarcely ever necessary fully to open the throttle; this means that the quality of reproduction is well maintained under all conditions.

SPECIAL FEATURES OF THE A.C. HALL-MARK.

Quality and Large Undistorted Output at Low Cost—2½ watts undistorted output.

Well-tried Circuit—Variable-mu H.F., Leaky-grid Detection, Push-Pull Output.

Ideal for use as Radio Receiver or Radio-gramophone.

Easy Construction—Coils with self-contained W/C switches. Simple Components and Circuit.

Ample selectivity for normal requirements—due to use of aerial coil with loose-coupled winding, and use of efficient H.F. transformer with tuned secondary.

Smooth Reaction Control which increases selectivity when required.

Graded Volume Control by Variable-mu Potentiometer.

Ample Decoupling in all Circuits.

Absence of Mains Hum because of thorough decoupling, and use of Large-capacity Electrolytic Condensers.

ORDER NEXT WEEK'S 64-PAGE ISSUE CONTAINING THE FREE GIFT BLUEPRINT NOW!

OLD CIRCUITS IN NEW GUISES—2

The Similarity of Modern Selectivity Devices with Those in Use Many Years Ago is Pointed Out in This Article

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

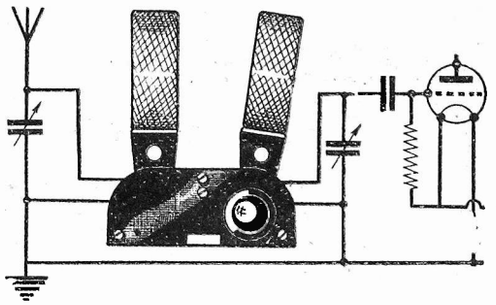


Fig. 1.—An early loose-coupled tuner.

OF late it has become quite normal practice to use two or more loud-speakers with a single receiver, in order to achieve a more realistic reproduction, these speakers being of differing characteristics, so that while one looks after the high notes, the other is responsible chiefly for the lower notes. The high-note speaker is often referred to as a "tweeter," and whereas the other speaker or speakers are usually of the moving-coil type, tweeters are nothing more or less than a direct development of the moving-iron horn speakers we knew so well many years ago.

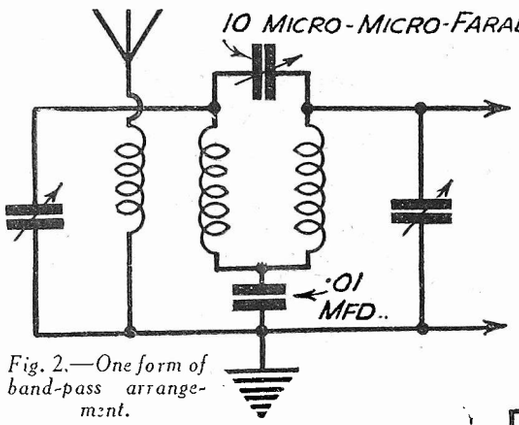


Fig. 2.—One form of band-pass arrangement.

Coupled Circuits

Turning once more to circuits, the now popular "band-pass" tuning is a lineal descendant of a very early device, although twisted almost out of all recognition. One of the very first devices to obtain high selectivity was the use of two tuned circuits, with variable coupling between them. The two circuits usually took the form of a pair of plug-in coils, mounted in a two-way swinging coil holder, and each tuned by a variable condenser, as shown in Fig. 1. The coupling between the two circuits was purely magnetic, and could be varied by swinging the coils in their holder. Old experimenters will remember that there was always one point of adjustment when signals were at their maximum, and that by decreasing the coupling, signals dropped in strength but the selectivity was improved. Possibly they may also remember that if the coupling was made too tight there was also some falling away of signal strength and a flattening of the tuning, while further tightening of the coupling gave two tuning points for a given wavelength.

This form of variable coupling is not used nowadays, but a development of the idea has stood us in good stead, for the band-pass device simply consists of two tuned circuits in which the coupling, which is now usually capacitative, although sometimes a mixture of capacitative and inductive, is sufficiently tight to cause two "optimum" tuning points separated about 9 kilocycles apart but with a fairly steep cut-off beyond this band. In this way a reasonable proportion of the sidebands are received without serious attenuation, and quality is, therefore, much better than with very sharply tuned circuits which cut off nearly all the sidebands. At the same time, the filter cuts off a large proportion of the sideband interference from stations working on adjacent wavelengths. Figs. 2 and 3 show typical band-pass circuits, while in Fig. 4 is illustrated the effect on the sidebands of sharply-tuned and band-pass circuits.

Wave Traps

Another old friend is the wave trap. Several different variations were developed when ether congestion first became acute and before really selective receivers were in general use. The series rejector trap shown diagrammatically in Fig. 5 was the most usual. It consists of a coil, tuned by a shunt condenser, and the whole connected in series with the aerial. Usually the trap was made up as a separate unit, one terminal being connected to the aerial lead and the other to the aerial terminal of the set. In use, the trap was tuned to the unwanted station, and no signal of that frequency got past the trap to the set.

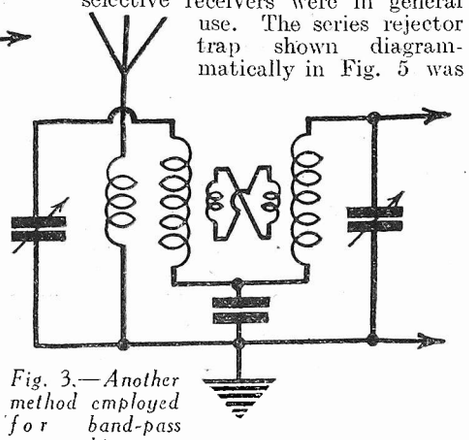


Fig. 3.—Another method employed for band-pass working.

In due course, when receivers having an adequate degree of selectivity became general, the use of wave traps declined. But from time to time they have cropped up again, in commercial form and as adjuncts to home-made sets. Such a device might be useful in those very few cases where a listener is unfortunate enough to live right under the shadow of a powerful transmitting station, but I have known many commercial and home-made sets which are sufficiently selective to cope even with these adverse conditions without a wave trap.

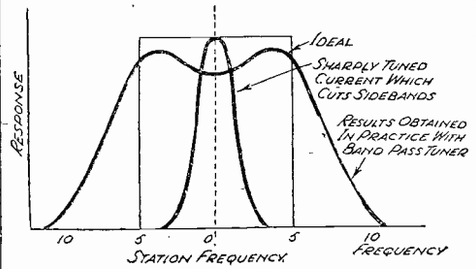


Fig. 4.—Showing how the resonance curves are altered under different conditions.

A Special Case

There is, however, one application of the wave trap which has recently cropped up, and is quite excusable, namely, for use in those districts where the additional power of the new Droitwich transmitter renders some additional selectivity essential in order to permit clear reception of Radio-Paris and the long-wave German station. Here, then, is an example of an old device being revived to solve exactly the same problem as that which called forth the device in the first place.

Many years ago, a system known as "constant aerial tuning" was introduced. This consisted of placing a small condenser in series with the aerial—a device well known to-day, although we have given up calling it by a fancy and rather meaningless name. Aerial coupling by means of a small condenser is employed as an aid to selectivity, and many sets are fitted with two or more aerial terminals, each connected through a condenser of different value, so that the series coupling capacity can be varied to suit long or short aerials and the listener's own needs by way of selectivity. Alternatively, a variable condenser is incorporated in the set for the same purpose.

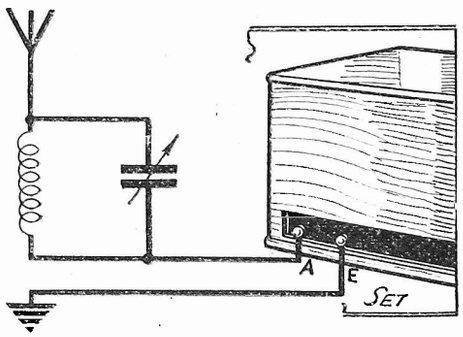
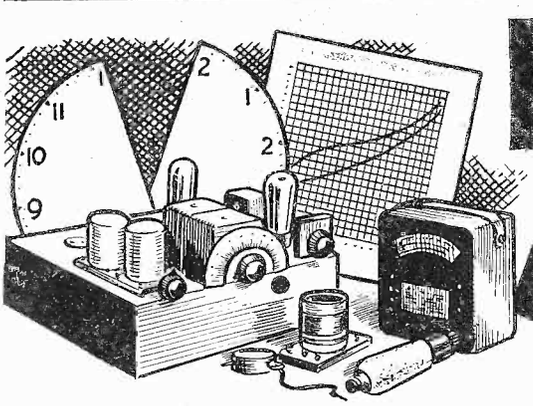


Fig. 5.—The complete series rejector wave-trap.

This device is perfectly sound and useful, but unfortunately it has been abused from time to time. Devices have been put on the market under various proprietary names, and often at an unwarrantably high price. In a few cases the device has proved to be nothing more or less than a small fixed condenser, often of the crudest type, mounted in an imposing-looking case. Now a series condenser can certainly improve selectivity. But it cannot, in any circumstances, increase volume—actually it must reduce the signal input. For this reason, not only will volume be reduced—unless increased amplification is provided in the set—but the number of stations which can be received at good strength will be reduced.



HALF-HOUR EXPERIMENTS

By FRANK PRESTON

BY way of a change, it is proposed this week to describe a number of interesting experiments in connection with high-frequency amplification, dealing with the methods employed before the days of the screen-grid valve. Those readers whose experience of wireless goes back eight or nine years will probably have recollections of the high-frequency amplifier of the type using a general-purpose triode valve. They will also remember the remarkable improvement that was effected by the substitution of a valve having an additional

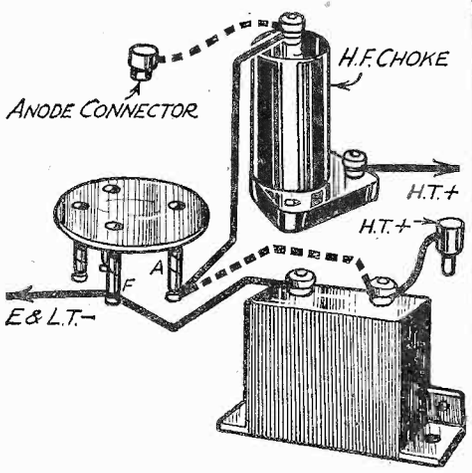


Fig. 1.—Showing how the connections can easily be altered in order to experiment with a three-electrode H.F. valve. Previous connections are shown by broken lines.

electrode—the screening grid. But there are doubtless many whose wireless experience is very limited, and there are certainly many thousands who did not take up wireless as a hobby until PRACTICAL WIRELESS was first published about two and a quarter years ago; these readers, particularly if they are of an experimental turn of mind, will find much of interest in trying out the old circuits.

Triode H.F. Amplification

"Ordinary" H.F. amplification, in which a valve of the H.F. or H type is employed, can be tried very easily by those who have a receiver fitted with an S.G. or V.M. stage simply by removing the leads at present going to the screening-grid terminal on the H.F. valve-holder, and in their place connecting the lead which made contact with the anode terminal fitted to the top of the valve. The idea is illustrated in Fig. 1.

What will be the first observations on making these altered connections? It all depends upon the tuning circuits employed, the efficiency of the coils, and the degree of screening provided. Where the H.F. and

The Experiments Described in This Sixth Article of the Series are in Connection with Neutralised H.F. Amplification, and Details are Given for Making Suitable Coils

detector valves are coupled together on the tuned-grid principle (as they generally are), and if the coils are well screened, it is possible that no very tremendous change will at first be noticed. It will, of course, be found that the degree of H.F. amplification is very much curtailed, and it might be found that many of the stations that were easily received before cannot now be heard at all. On the other hand, if the coils are of a very efficient type—iron-core coils in particular—or if the components are not screened very thoroughly, it is more than likely that the set will become unworkable, especially on the more distant stations. The reason for this will be that the three-electrode valve used in the H.F. stage will immediately fall into self-oscillation, and this oscillation will be unaffected by use of the reaction condenser.

Complete Screening

In the case of air-core coils it will generally be possible to minimise the instability by adding additional screening, preferably fitting an aluminium screening box all

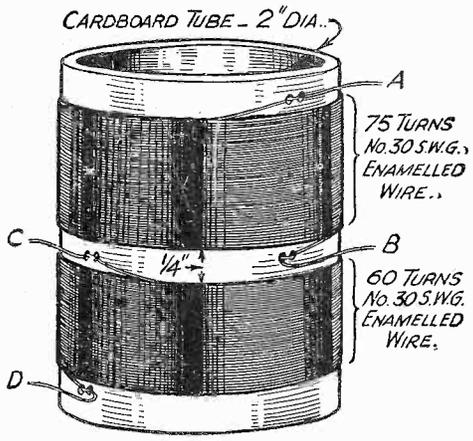


Fig. 3.—Winding details of the neutrodyne coil shown in Fig. 2.

round the H.F. components—aerial coil, aerial tuning condenser (when separate condensers are used), and the valve itself. In doing this it must be remembered that all parts of the screening box must be in good electrical connection and earthed, and that the metal box must not only extend round the sides of the components, but must also pass over and under them. This means that the connecting leads must be passed through holes made in the metal box. Incidentally, it might be mentioned that suitable screening boxes

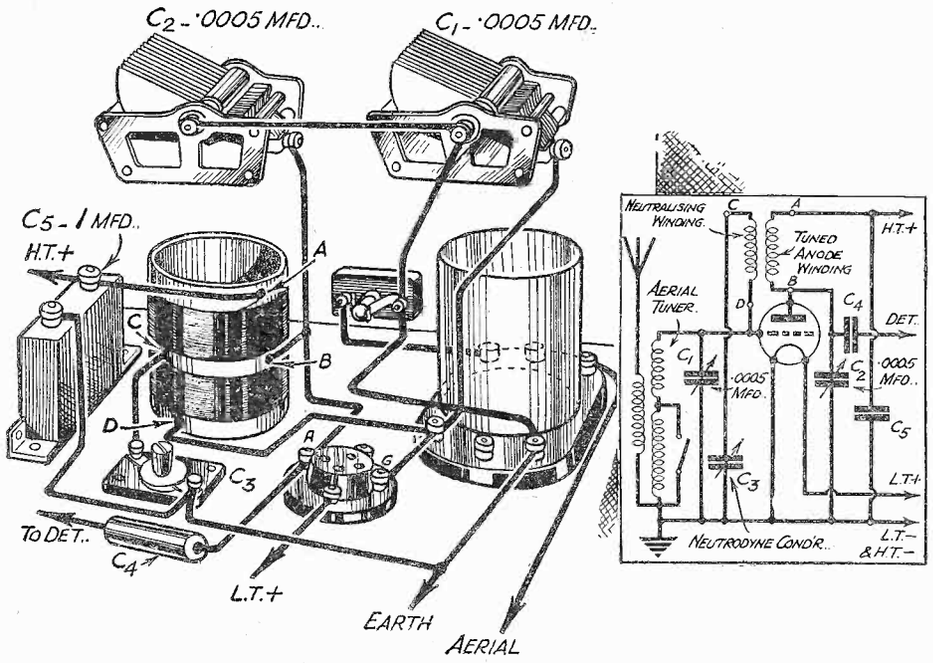


Fig. 2.—Theoretical and pictorial circuits of the neutrodyne circuit described.

are still available in ready-made form from a few manufacturers, whilst they can often be bought very cheaply from dealers in surplus gear.

Despite the fact that three-electrode valves are never used in modern receivers for H.F. amplification, it is often possible to obtain quite good results after thorough screening has been provided. The results to be obtained are, in fact, vastly superior to those which were possible before the S.G. valve made its advent; this is because the modern triode is considerably better than those made a few years ago, and has a much lower inter-electrode capacity.

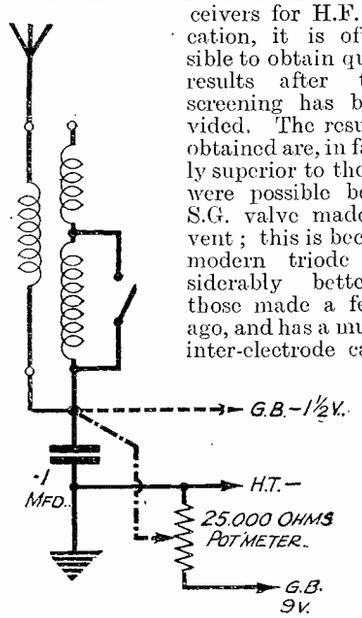


Fig. 5.—Fixed or variable grid-bias can be applied to the H.F. valve by using the connections shown in broken or in chain lines respectively in this circuit.

Neutralising Inter-electrode Capacity

Mention of inter-electrode capacity leads us to neutralised H.F. circuits, often referred to as neutrodyne circuits, which were used with very great success from eight to ten years ago. The reason for the instability and self-oscillation in the case of the three-electrode H.F. valve is that the capacity between the grid and anode allows a portion of the H.F. energy in the anode circuit to pass back into the grid circuit, just as this feed-back occurs with a detector valve when reaction is applied. It was this problem that designers had to overcome before the H.F. amplifier could attain the measure of perfection which it has achieved to-day. Knowing that it was the capacity between the electrodes that was responsible for the difficulties encountered, it was a logical sequence to look for a method of counteracting or neutralising that capacity, and it was this that was done in the case of the neutrodyne circuit. Fig. 2 shows theoretical and pictorial circuits of a neutralised H.F. stage in which tuned-anode coupling is employed between the first and second valves. It will be seen that a second winding is placed near to that forming the tuned circuit, and this is joined to the grid and earth through a neutrodyne condenser. A certain amount of energy is induced into the neutrodyne circuit from the tuned-anode winding, and this is of opposite *phase* to that existing in the grid circuit. If, therefore, the capacity of the neutrodyne condenser is approximately equal to the grid-anode capacity of the valve, the latter capacity is cancelled out. This explanation is brief and approximate only, but it will suffice for the practical man.

Making the Coil

In Fig 3, details of the two windings are given for a coil covering the lower broadcast band, so that the experimenter can easily try out this circuit. It is necessary that the voltages developed in the neutralising winding should be opposite in phase to those in the tuned winding, and for this reason it might be necessary to reverse the connections to one of the windings.

The method of adjusting the neutrodyne condenser is as follows: First tune in the local station, and then disconnect one of the filament leads to the H.F. valve. Signals will then be made very weak—so weak, in fact, that it might be necessary to place the ear close to the speaker to hear them at all. The neutrodyne condenser should then be adjusted until the signals vanish entirely, or become as weak as they can be made. In this latter respect it should be mentioned that it might be found that signal strength diminishes as the knob of the neutrodyne condenser is screwed down to a certain point, after which it commences to increase again. Should this prove to be the case, the condenser must be set to its midway point.

When that has been done, the filament connection to the H.F. valve should be remade, when it should be found that self-oscillation no longer exists. Reception should then be as good as when an S.G. valve is employed. The latter statement might be challenged by pointing out that the S.G. valve would never have become so popular if this were true. That argument may be disposed of by saying that the fairly tricky adjustment of the neutrodyne condenser is the chief objection to the neutralised coupling. Another objection is that neutralising cannot very well be applied to a dual-range tuner; if it is, it becomes necessary to alter the neutralising capacity every time a change is made from one waveband to the other, and that is a sufficient deterrent to the average listener, although perhaps not to the experimenter.

Dual-range Tuning

Dual-range working can be accomplished, however, in a satisfactory experimental manner by using two independent tuning units for medium and long waves, and by providing a switch to change from one to the other. When such a scheme is to be tried, a second coil unit similar to that illustrated, but where each section consists of four times as many turns, can be employed. The two windings will then be pile-wound in four sections by fitting cardboard washers to the cardboard tube.

When the experimenter has a few plug-in coils on hand, neutralising can be tried by using the circuit shown in Fig. 4. Here the tuned-anode coil can be a number 75 or 250 (for medium and long waves respectively), whilst the neutralising coils can be numbers 50 and 200. It will be seen that two holders are provided for the neutralising coils, these being placed one on each side of the tuned coil. The object in doing this is that the two neutrodyne condensers can be adjusted to their correct capacities for both wavebands, the result being that it is only necessary to plug in suitable coils to change over. It should just be added that the coil sizes mentioned are approximately correct, but it is desirable to try others so that the most suitable can be obtained by experiment.

There are several other methods of arranging neutralised circuits, but that dealt with in this article is probably the most convenient and efficient. In using a three-electrode valve for H.F. amplification it is generally better to apply a small amount of negative grid-bias, since this tends to increase stability, and also to increase the signal-handling capacity of the valve. The bias can be applied in exactly the same manner as with S.G. and variable-mu valves by breaking the lead from the "bottom" end of the aerial coil to earth, inserting a .1-mfd. non-inductive, fixed condenser, and taking a lead from the coil to a tapping on the G.B. battery or to a 25,000-ohm potentiometer, as shown in Fig. 5.

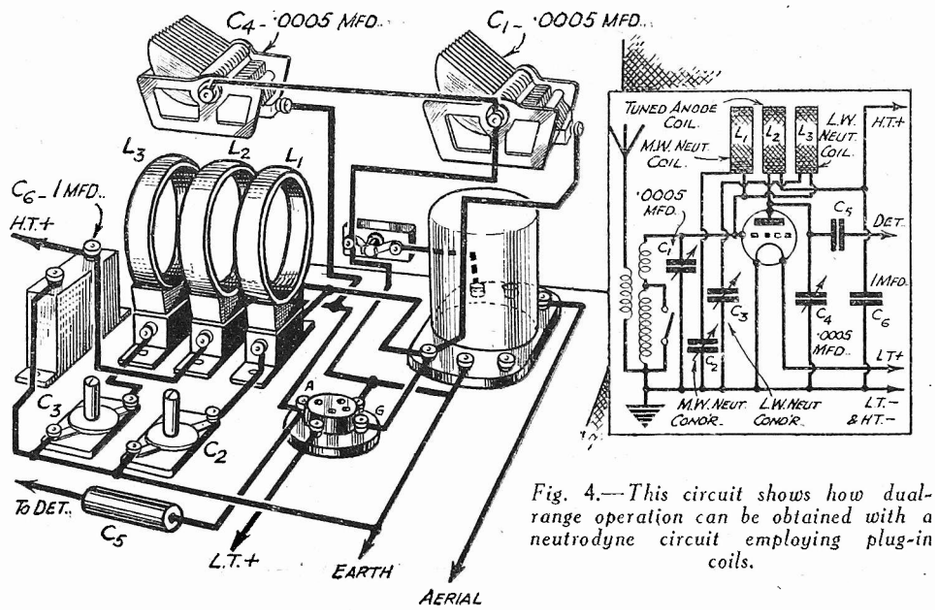


Fig. 4.—This circuit shows how dual-range operation can be obtained with a neutrodyne circuit employing plug-in coils.

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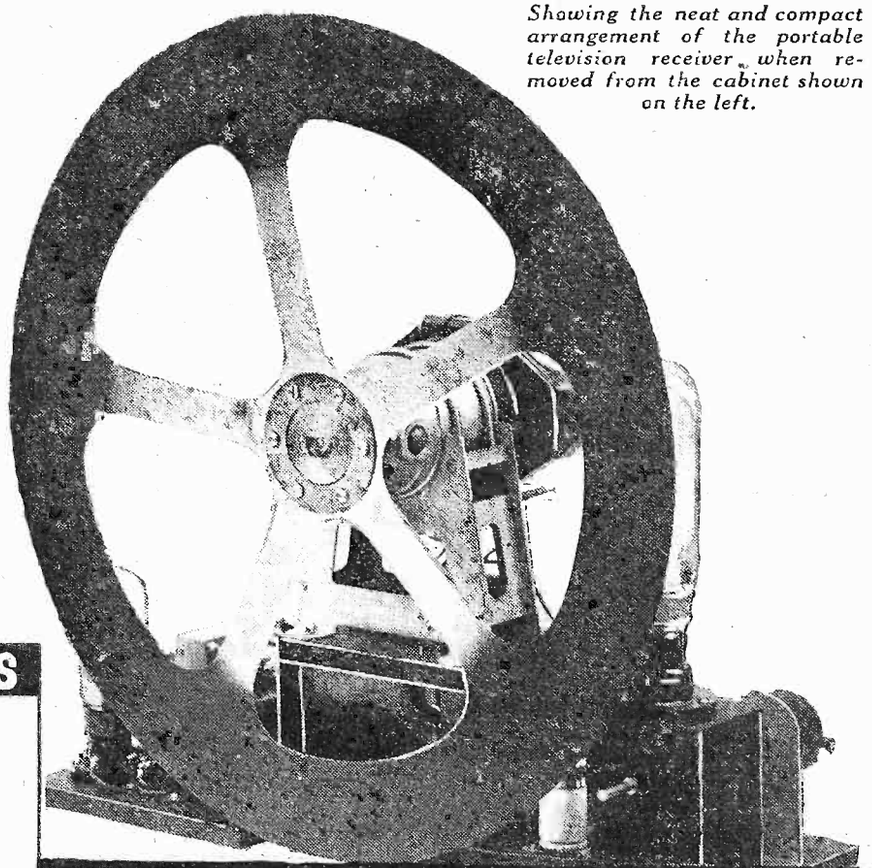

Showing the neat and compact arrangement of the portable television receiver when removed from the cabinet shown on the left.

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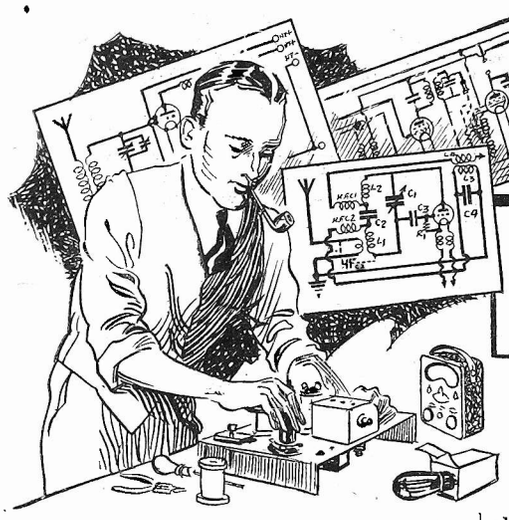


CIRCUITS AND SETS FOR ALL

The Subject of this Fifth Article in the Series is a Simple Three-valve Receiver for All-wave Reception.

By Frank Preston.

POSTCARDS received from a number of readers concerning the type of receiver which they would like to see described in this series indicate that a large percentage are in favour of an all-wave (that is short, medium, and long wave) set of simple type. There are many ways of designing such a set, but there are two important points to be considered in connection with a design that is to be published in these pages; the first of these is that the receiver must be reasonably easy to construct, and the second is that it shall not be tricky to operate.

Both of these requirements, as well as the additional ones of low cost and high efficiency, have been considered carefully in drawing up the circuit shown on this page. Only a cursory examination is necessary to show that the arrangement is on very simple lines, whilst it will also be seen that the valves are all of the pentode type which have proved so entirely satisfactory in modern circuits. The first two valves are high-frequency pentodes, whilst the third is a high-efficiency L.F. pentode.

Aperiodic Aerial Coupling

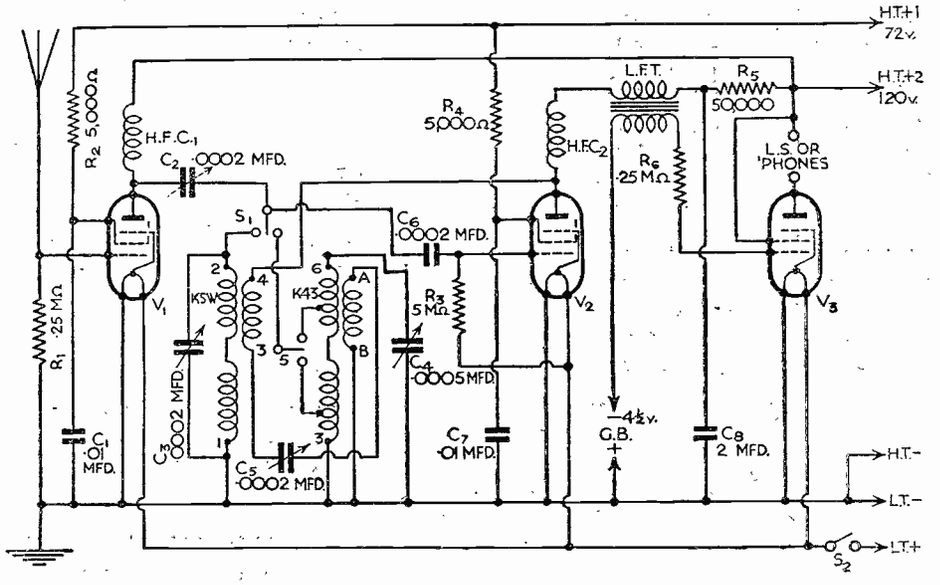
A rather unusual feature of the circuit is that the aerial system is not tuned, the input signal voltages being developed across a .25-megohm non-inductive resistance. This arrangement is not so satisfactory, in theory, as an accurately-tuned circuit, but in practice it is generally better for short-wave reception, since it is extremely difficult to tune two separate circuits quickly and with any degree of accuracy. In addition to this, however, it is rarely that any appreciable degree of H.F. amplification can be obtained on short waves, and the principal object of the first valve is to remove "dead spots" in the tuning range, simplify tuning, and to minimise hand-capacity effects. On the medium and long waves the value of the H.F. amplifier is rather slight, but it does, at least, prevent the set from radiating interference if it should be brought right up to the oscillation point. Additionally, the first stage tends to stabilise the detector, and it is justified on these grounds.

LIST OF COMPONENTS REQUIRED.

One Metaplex chassis, 12in. by 10in., with 3in. runners.—Peto-Scott.
One aluminium panel, 12in. by 8in.—Peto-Scott.
Three 4-pin chassis-mounting valve-holders.
One .0005-mfd. variable condenser with drive (C4)—Formo.
One .0002-mfd. variable condenser (C3)—Jackson Bros.
One slow-motion-drive—Utility "Micro-Dial."
One change-over switch (S1)—Bulgin, type S.81.T.
One .0002-mfd. reaction condenser (C5)—Jackson Bros.
One on-off switch (S2)—Graham Farish.
Six 1-watt fixed resistances: .25 meg. (R1), 5,000 ohm (R2), 5 meg. (R3), 5,000 ohm (R4), 50,000 ohm (R5), .25 meg. (R6)—Dubilier.
One coil assembly, comprising KSW and K43 coils on baseplate, with combined wave-change switch—Colvern.
Two universal H.F. chokes (H.F.C.1 and H.F.C.2) Eddystone.
One 5:1 L.F. transformer (L.F.T.)—Varley "Niclet."
Four fixed condensers: two .01 mfd. (C1 and C7), one .0003 mfd. (C6), one 2 mfd. (C8) T.M.C.
One .0002-mfd. pre-set condenser (C2)—Formo.
Connecting wire, terminals, etc.
Three valves: two 210 SPT (V1 and V2) and one 220HPT (V3)—Cossor.

Two Tuning Condensers

Two separate tuning condensers are fitted, one of these (C3) having a capacity of only .0002 mfd. and being for short-wave tuning only. The other one (C4) has the standard capacity of .0005 mfd. and tunes on medium and long waves. The short-wave condenser is provided with a slow-motion drive to enable accurate and easy tuning to be accomplished, but it is found that a plain dial can satisfactorily be used with the .0005-mfd. condenser. The method of connecting the reaction windings of the two coils is unconventional and might at first appear to be incorrect; actually it is from the circuit diagram for the sake of simplicity.



The circuit of the all-wave receiver described.

Coupling between the first two valves is on the customary tuned-grid principle, a universal or all-wave H.F. choke being included in the anode circuit of the first H.F. pentode. It will be seen that two complete tuners are employed, one of these covering the short waves from just under 18 metres to 65 metres in two bands from 18-35 and 30-65 metres, and the other one covering the normal broadcasting bands from 220 to 550 metres, and from 900 to 2,000 metres. The two coils can be obtained on a common baseplate with a wave-change switch rod operating on both. Thus, the higher or lower band on either short or broadcast wavelengths can be chosen by using the same switch. Another switch (S1) is used to change over from the short-wave coil to that which covers the broadcast bands. It should be mentioned in passing that the wave-change switches fitted into the coils are omitted very satisfactory in practice. The two windings are in series with each other and with the .0002-mfd. reaction condenser (C5); thus, both windings are in circuit on every waveband, and the same reaction condenser serves in every case.

One further point which should be explained in connection with the tuning circuits is that when the switch S1 is turned to the "broadcast" position the anode coupling condenser and the detector grid condenser are connected to terminal 5 on the K43 coil, and this provides a transfer tapping, so that a high degree of selectivity is available on both medium and long waves.

H.F. Pentode Detector

The detector circuit follows standard practice, apart from the fact that an H.F. pentode is used instead of the more usual

(*Continued overleaf*)

(*Continued from previous page*)

triode valve. The screening-grid potential for this valve, like that for the first one, is obtained through a 5,000-ohm decoupling resistance, a .01-mfd. tubular condenser being used to by-pass the radio frequencies. A 5 : 1 ratio transformer is used to couple the detector to the L.F. pentode, and a .25-megohm grid leak is used in the grid circuit of the third valve to act as a "stopper" to any high-frequency currents that "escape" past the detector H.F. choke.

With regard to the assembly of the components, it should be pointed out that the lay-out is in this case very important since capacity between the connecting wires, and also between the grid- and anode-circuit components, must be kept down to a minimum. For this reason the two-coil assembly should be situated in the centre of the chassis, with the two tuning condensers placed one on each side of it. The reaction condenser is best placed below the chassis and immediately beneath the coils. The change-over switch (S1) should be placed on the panel just over the wave-change switch fitted to the coils, and the on-off switch (S2) can be situated to the right of the panel.

Arranging the Components

Place the valve-holders in a line along the back of the chassis with that for the detector valve immediately behind the coils, those for the other two valves being situated about 4in. on each side of the centre. As two similar H.F. chokes are used in the anode circuits of both the H.F. and detector valves it is important that these should be so placed that coupling cannot occur between them. For this reason they should be mounted at right angles to each other, whilst that for the H.F. valve should be on the under side of the metallised baseboard, and the other on the upper surface, as near as possible to the anode terminal of the detector. As to the other components, the L.F. transformer should be placed beneath the chassis surface along with the decoupling resistances and by-pass condensers; all other components can then be mounted on top of the chassis.

The method of arranging the battery connections is not important, but it will probably be found most convenient to fit flexible leads directly to the various components, but a terminal strip could be placed along the rear edge of the chassis if desired. Either terminals or terminal-socket strips can be used for the aerial, earth, and speaker connections, but these are not specified, since the constructor will probably have his own pet ideas on the best method of arranging these connections.

Adjusting and Tuning

The method of operating the finished receiver does not call for a lengthy explanation, since it is particularly straightforward and nearly as simple as that employed with a normal broadcast receiver. After switching on, the change-over switch should be set to the broadcast position, when either long- or medium-wave reception can be obtained by turning the wave-change switch on the coil to the left or right, respectively. Set the reaction condenser to zero (anti-clockwise rotation) and turn the knob of the right-hand (.0005 mfd.) tuning condenser until the local station is received. The capacity of the pre-set condenser (C2) can then be varied until best results are obtained; it will be found that as the capacity of this condenser is increased by screwing down the knob, signal strength is increased to a certain extent, although tuning is not quite so sharp.

When this condenser has been adjusted reaction can be increased, when it should be found that ten or more stations can be received at good loud-speaker strength. Should it be found that reaction control is at all "fierce," a different position in the battery of the H.T.+1 tapping marked 72 volts should be tried. It might also be pointed out that the grid-bias voltage marked on the diagram will be correct only if the maximum H.T. voltage of 120 is applied to tapping H.T.+2, and if the specified valve is used in the output stage. If the voltage or valve is changed the G.B. must be varied accordingly.

When it is found that the set functions correctly on the broadcast bands, the change-over switch may be turned to the short-wave position and tuning carried out by the left-hand condenser. This condenser should be operated as slowly as possible after the reaction condenser has been set *nearly* to the oscillation point; that is, until a faint "breathing" sound is heard in the speaker or 'phones. A good number of transmissions should be received on both of the short-wave bands, but it should be remembered that short-wave reception is very variable, and fluctuates according to prevailing conditions, as has been explained in these pages before. In order to keep the set in its most sensitive condition—just on the verge of oscillation—it will be found necessary slightly to vary the capacity of the reaction condenser as the tuning condenser is turned.

If any difficulty is experienced in making the set oscillate on short waves, or if reaction control appears rather unsteady, the pre-set condenser should carefully be adjusted until the best position is found. It will probably be noticed that when this condenser is set to about its midway position a fair compromise between selectivity, sensitivity, and smoothness of reaction control is obtained on each of the four wavebands.

A Simple Television Receiver

A Novel Method of Making an Efficient Television Receiver

At the present time there are only three main types of television receivers in general use, and these are the disc, mirror-drum, and cathode-ray receivers. While the last has many good points it also has two great disadvantages, which are its high cost and its complexity of design. The two former systems are the most popular, but even they have their disadvantages. The disc receiver is rather large and unwieldly, and while the mirror-drum receiver is less bulky, it is more expensive and quite a powerful motor is needed to rotate the drum. Here is an entirely new type of receiver, however, that has two very good points, which are its low cost and compactness, for the whole apparatus could be built into a box the size of a small hand camera.

The Scanning Medium

Instead of using a large disc or heavy drum as the scanning medium, a thin light strip of black celluloid or film is employed. This film is perforated with a number of small holes spaced at regular intervals in just the same manner as is the disc of a disc receiver. The accompanying illustration shows the general construction of the receiver, and it will be seen that it closely resembles the principle of a small cinematograph projector. Square holes punched at each side of the film enable two sprocket wheels, one of which is mounted at each side of the driving motor, to drive the film past the neon lamp at the correct speed.

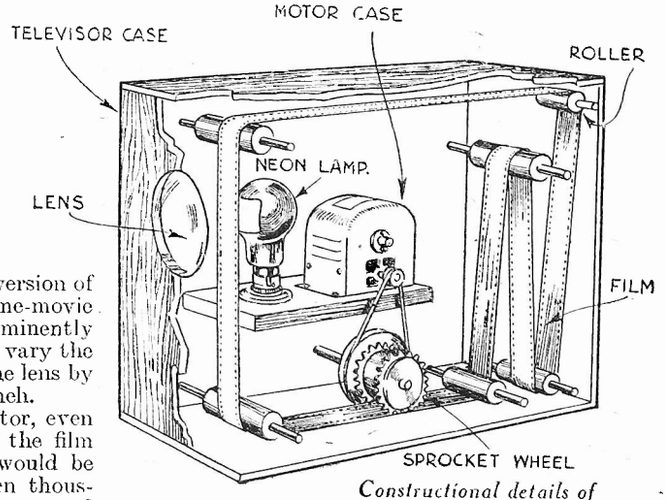
There would be no stretching or buckling of the film, for modern methods of manufacture ensures that it maintains its original size and shape under the most adverse of conditions.

The Driving System

As regards the driving of the film, an adapted version of the system used in home-movie projectors would be eminently suitable, for such does not vary the position of the film to the lens by even a thousandth of an inch.

In a home-movie projector, even the slightest diversion of the film from its correct position would be magnified hundreds or even thousands of times on the screen, and as no flickering can be discerned even then, the great accuracy of the film driving system can be realised.

It must be remembered, too, that the motion of the film in a movie projector is not continuous as it is in the television receiver, but is alternatively stopped and started, so there need be no fear regarding the film moving from its correct position.



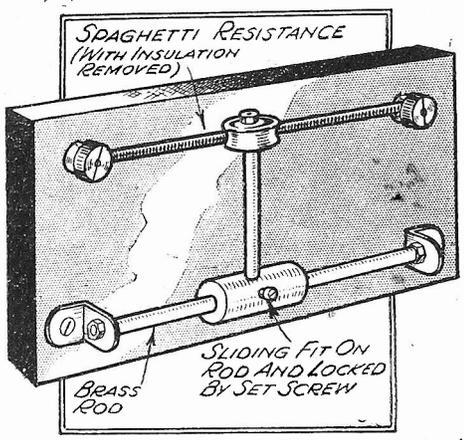
Constructional details of the apparatus.

READERS' WRINKLES

THE HALF-GUINEA PAGE

An Experimenter's Potentiometer

POTENTIOMETERS of different values are not always at hand in the junk box, but the one illustrated can be quickly



A simple potentiometer made with a spaghetti resistance.

made from a spaghetti resistance, which is easily replaced so that various values can be used as required. A spaghetti of known value is stretched between two pillar terminals, as shown, and a piece of brass rod is supported between two right-angle brackets so that the rod and spaghetti are parallel. A slider, made from an old wire connector, carries a small, grooved wheel, which makes contact with the resistance wire. By shorting a section of the resistance, its value in the circuit can be halved or quartered, etc., and almost any value can be obtained by using resistances of different values. The resistance must, of course, be carefully stripped of its insulation.—J. MASTERSON (Gt. Yarmouth).

A Dual-purpose Connector

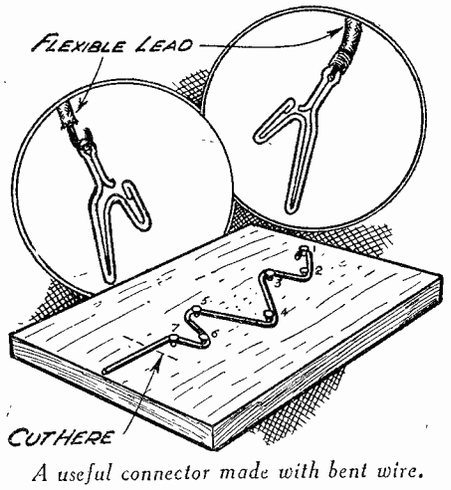
THE experimenter is always needing connectors, and flex is usually more suitable than solid wire. But it is awkward to thread flex through the eye of one type of binding screw and often just as awkward to twist round the stem of another type, whilst it is worse still when the socket for a wandering plug is concerned. The connector I have evolved is shown in the accompanying sketches. The longer limb forms a "pin" tag, the shorter one forms a "wander plug," and is slightly springy to afford a good fit, whilst the whole forms a satisfactory "spade." It is very readily made of No. 20 s.w.g. copper wire.

The wire is bent to shape with the aid of a former, which consists of a piece of fairly hard wood with fine nails driven in, as shown. Shoe brads will answer the purpose (the heads being cut off) so as to leave about an eighth of an inch projecting. Take the length of wire, and at one end bend a small loop as at Fig. 1, and then bend closely round each point in succession, keeping a good tension. Cut off just below point 7. With pliers, pinch up the wire at points 1, 2, and 4, and at 6 do the same, but pinch round one of the nails

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL 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 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.

so as to form a slight loop, and at point 5 bend the stem now formed outwards instead of inwards, when the tag will be completed. Strip the ends of a piece of flex, pass the wires through the eye of the stem, twist them, then bind firmly with cotton. A spot of solder at the junction point of the three limbs will be an advantage, though not a necessity. Make some and be happy! If a number of these connections is to be made it will be found expedient to drill a piece of ⅛in. sheet brass, and solder in short lengths of wire, instead of using the wood block and nails. —H. C. EDWARDS (Reading).



A useful connector made with bent wire.

Condenser Calculations Really Simplified

THE usual formula given for calculating the total capacity of two condensers in series is that it is equal to the reciprocal of the sum of the reciprocals of the separate capacities. In addition to being rather a mouthful, this necessitates quite a little figuring out, even to the expert arithmetician; but it can be made much more simple than that.

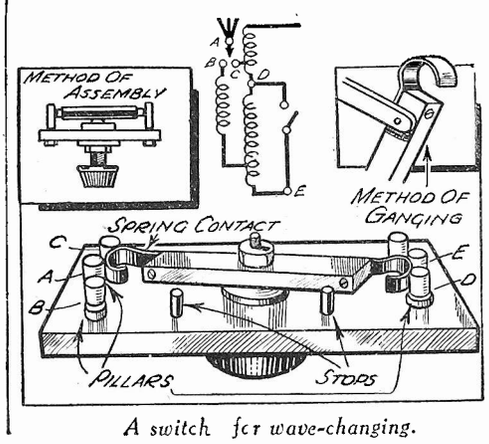
Knowing that the resultant capacity of two condensers of equal rating in parallel is exactly the half of either of them, and knowing also that the self-same rule applies in optics, it occurred to me that the optical formula (which is quite a simple one) might apply also to condensers in tandem. It does.

The formula for lenses is $F=\frac{f_1 \times f_2}{f_1+f_2-s}$ where F is the resultant focus, f_1 and f_2 the respective foci of the combined lenses, and s the separation, all measurements being in the same units; thus the combined focus of two lenses each of 2-in. focus would be (assuming they are in contact—no separation) $\frac{2\times 2}{2+2}=\frac{4}{4}=1$in.

But the values of condensers are seldom in whole numbers; yet that fact need not worry us, for it does not complicate matters in the least. Suppose we have condensers of 0.001 mfd. and 0.0003 mfd. in tandem or series, all we need to do is to reduce them to like quantities. The first is obviously ten ten-thousandths and the second three ten-thousandths. Treating them as whole numbers, we have (converting the optical formula) $C=\frac{c_1 \times c_2}{c_1+c_2}$ therefore $\frac{3\times 10}{3+10}=\frac{30}{13}=2.3$ (approx.). As our figures are in ten-thousandths, we only need to place three noughts and a decimal point in front of the figures we have obtained to make the resultant capacity of the two condensers 0.00023 mfd. And if you work it out by the longer and more troublesome reciprocal method you will find the answer the same. So why use reciprocals?—H. C. E. (Reading).

A Switch for Wave-changing

THE object of this switch, besides wave-changing, is to introduce a separate long-wave tapping through an anti-break through switched-in choke. The six contact studs are mounted rigidly, and the appropriate connections made to the terminals by nuts or solder. The brass portions on the moving arm are made of springy brass, shaped as nearly into a circle as possible, and fastened by metal thread into the tapped ebonite strip. If a quarter of an inch spacing is allowed between the studs, a good snap action is obtained, with self-cleaning surfaces. The circuit diagram shows the connections to the various studs. Note that switches can be ganged if connected as shown in the top right-hand diagram.—F. PALMER (Peterborough).



A switch for wave-changing.

VALVE COUPLINGS—2

The Theory and Practice of Coupling Low-frequency Valves are Described in Easily-understandable Language

IN the previous article of this series it was explained why a fairly definite value of resistance should be included in the anode circuit of a valve if the maximum transference of energy from that valve to the next were to be obtained. The most suitable value of anode resistance is referred to as the optimum load, and the figure for this is generally given by the makers in respect of power and pentode valves, but not for other valves intended for use in the H.F., detector, and first L.F. stages. In these cases, however, it can generally be taken that the optimum load is approximately twice the rated impedance of the valve.

This will be made quite clear by examining the skeleton circuit given in Fig. 1, where a detector valve is shown coupled to the L.F. stage by a resistance-capacity circuit. The anode resistance R1 should have a value equal to approximately 25,000 ohms, assuming the use of a Cossor 210 det. valve in the detector position. It is necessary to point out that the decoupling resistance marked R2 does not enter into consideration at the moment, since it is not strictly situated in the anode-coupling portion of the circuit, being more correctly in the high-tension circuit, since it is by-passed by the decoupling condenser C2.

The next component to be considered in connection with the coupling arrangement is the L.F. grid condenser marked C1. The most suitable capacity for this condenser depends principally upon the value of R1, and the impedance of the condenser, at an average audio frequency of 1,000 cycles, should be low by comparison with that of R1. The graph in Fig. 2 shows how the impedance varies with capacity at 1,000 cycles, and it can be seen from this that a condenser of .05 mfd. has an impedance of 3,000 ohms or approximately one-tenth that of the coupling resistance. This is a good ratio to aim at, and therefore the correct condenser value for any anode resistance can be found from Fig. 2.

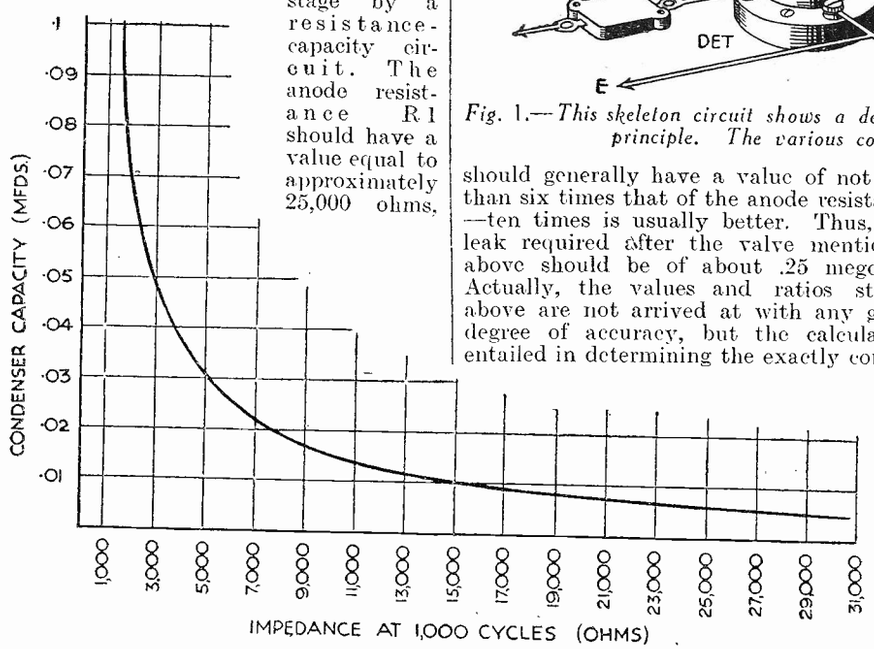


Fig. 2.—The above graph shows how the impedance of a condenser varies with capacity at an audio-frequency of 1,000 cycles.

Grid-leak Resistance

The L.F. grid leak R3 is the next component to be considered, and this should generally have a value of not less than six times that of the anode resistance—ten times is usually better. Thus, the leak required after the valve mentioned above should be of about .25 megohm. Actually, the values and ratios stated above are not arrived at with any great degree of accuracy, but the calculation entailed in determining the exactly correct theoretical values are involved, and their use is unnecessary for most design and constructional work.

The resistance-capacity coupling circuit so far dealt with is the fundamental arrangement, and once it is understood the other methods of coupling low-frequency valves are easy to follow. A form of coupling that is almost identical with R.C.C. is that known as choke-capacity, and for which the connections are the same as those given in Fig. 1, with the exception that an L.F. choke is used in place of R1. The choke should have an impedance, at an average speed frequency of 1,000 cycles, and when carrying the full anode current of the detector valve, of the same value as the optimum load of the valve. The latter explanation will more readily be followed when it is explained that the impedance of a choke always varies with the frequency of the alternating currents passing through it, and with the D.C. current which it has to carry, as well as with the inductance value. For example, a typical L.F. choke might offer an impedance of 50,000 ohms at 1,000 cycles and when carrying only 1 milliamp. of D.C. current, but the impedance might fall to only 20,000 ohms if the current is increased to, say, 5 milliamps. For this reason, when deciding upon the most suitable type of choke required, the

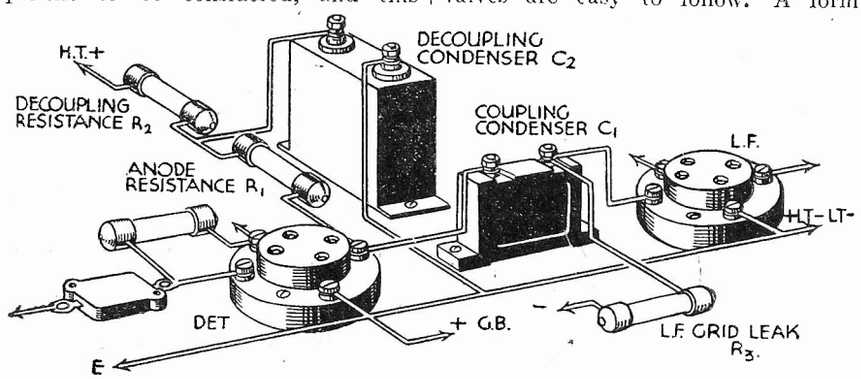


Fig. 1.—This skeleton circuit shows a detector valve coupled to an L.F. stage on the R.C. principle. The various components are referred to in the text.

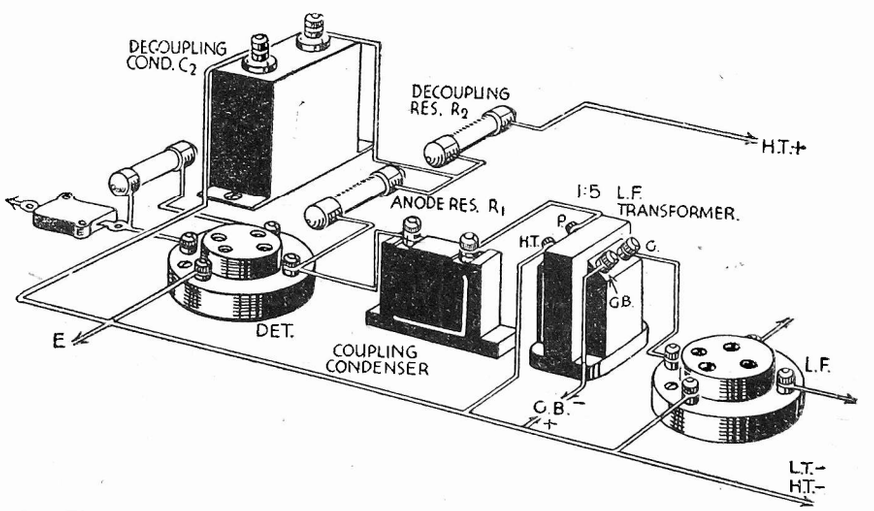


Fig. 3.—This skeleton circuit shows the connections for wiring an L.F. transformer on the parallel-feed system. The step-up ratio obtained is 5 : 1.

impedance should be based upon the inductance of the component when carrying the normal anode current. It will also be helpful to know that the impedance of a 20-henry choke at 1,000 cycles is 130,000 ohms; the impedance of other chokes at the same frequency can be determined by simple proportion, and a 40-henry choke would offer an impedance of 260,000 ohms in the conditions above laid down.

Choke-capacity Feed

It is often considered that distortionless amplification can only be obtained by using R.C. coupling, and there would be some truth in this if all audio frequencies were transmitted at equal intensities, and if the rest of the receiver gave "straight-line" response. The point is that the impedance (or resistance to A.C.) of a non-inductance resistance remains constant, regardless of the frequency of the currents passing through it, whilst the impedance of a choke or the primary winding of an L.F. transformer—which is the same thing—varies in proportion to the frequency. In practice, however, the L.F. choke is often better than a plain resistance in a circuit of the type shown in Fig. 1, because the D.C. resistance of the choke is much lower than that of the resistance. For example, a typical choke which has an impedance of 50,000 ohms at 1,000 cycles has a D.C. resistance of only 300 ohms. Because of this, there is a much smaller loss in voltage across the choke than across a corresponding resistance, so that a higher H.T. voltage can be applied to the anode of the detector valve without increasing the voltage of the H.T. battery. This is especially an advantage when power-grid detection is employed, when a detector valve is used which passes a high anode current, or when a screen-grid or H.F. pentode which has a very high impedance is used as a detector.

Transformer Advantages

As is well known, L.F. transformer coupling is quite different in practice from

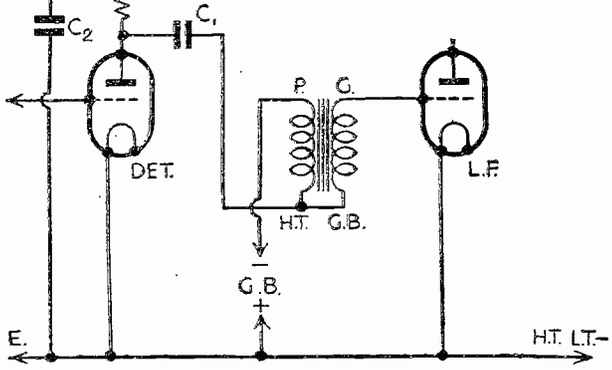


Fig. 4.—Showing how the 5 : 1 transformer should be connected to obtain a step-up ratio of 6 : 1.

either of the two forms of connection described above, but the same principles apply. For example, the primary winding should have an inductance of such value that it offers the correct impedance for the valve preceding it. As it is usual to use a transformer giving a voltage step-up, which means that the secondary winding must consist of a greater number of turns than the primary, the grid circuit of the following valve is automatically made of appreciably higher value than the anode circuit of the preceding valve.

The principal advantage of transformer coupling is that it permits of a voltage step-up between the two valves coupled together, and this results in increased amplification. In choosing a transformer, the question of the most suitable ratio has to be considered, although it should be made quite clear that this is of lesser importance than the inductance of the primary winding; a high step-up ratio and low primary inductance give results that are inferior to those obtained when the inductance is high and the ratio low. Provided that the primary impedance is sufficiently high, however, when this winding carries the full anode current, the higher the ratio the greater the degree of amplification. But the permissible degree of amplification is limited by two things. One is that if the ratio is made too high the secondary must contain such a large number of turns that the self-capacity becomes unduly high, with a result that reproduction is impaired and rendered low-pitched. Another limitation is imposed by the fact that if the voltage across the secondary winding is too great the consequent valve will be overloaded, and distortion will again be the result.

It can be taken as a general rule that a ratio of 5 : 1 can safely be employed between a normal detector valve and a high-amplification power-output valve, whilst a ratio of about 3 : 1 is generally better when a high-efficiency pentode follows the detector. When more than one stage of low-frequency amplification is employed it is generally wise not to use transformers having ratios in excess of 3 : 1—2 : 1, or even 1.5 : 1 are usually to be preferred.

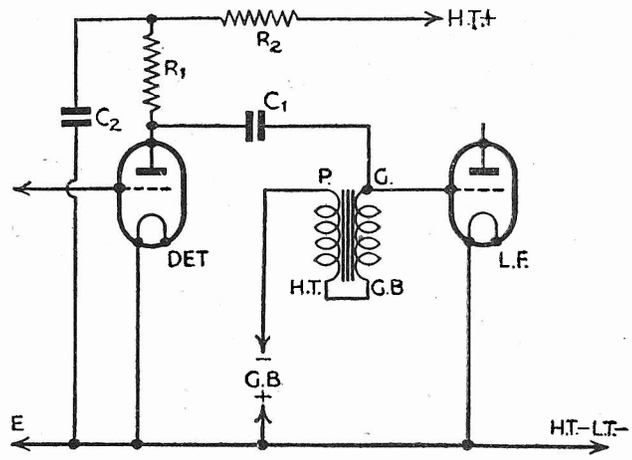


Fig. 5.—This theoretical circuit shows the transformer connections when a coupling ratio of 1 : 1 is required.

The Modern Method

Ordinary transformer coupling is rapidly going out of favour for most purposes, due to the fact that a transformer whose primary will provide a sufficiently high impedance whilst carrying the full anode current of the modern detector valve (especially in a mains set) is necessarily expensive to produce. But the advantages of transformer coupling can be combined with those of resistance-capacity coupling by using the parallel-feed, or resistance-feed arrangement shown in Fig. 3. In this case the value of the anode resistance, and also of the coupling condenser, can be determined by the methods described earlier. By using this circuit it is possible to employ quite a low-priced transformer, the primary of which has an amply-high inductance when not carrying any D.C. current, although it would be far too low if current were passed through it.

Another advantage of parallel-feed transformer coupling is that the step-up ratio can be varied from 1 : 1 to 6 : 1 in the case of a component with a turns ratio of 5 : 1, or up to a ratio of 4 : 1 when the turns ratio is 3 : 1. The methods of connecting the transformer to secure the various step-up ratios are shown in Figs. 3, 4, and 5, where the transformer shown is rated at 5 : 1.

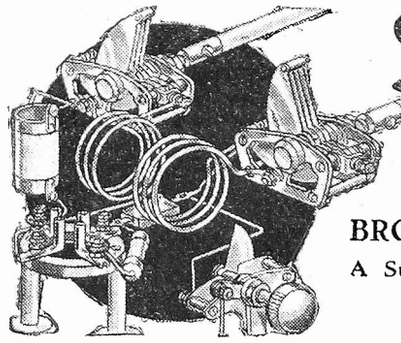
A later article will explain the principles, and also the practical details, involved in coupling Class B and other push-pull circuits.

TELEVISION SIGNAL DISTORTION

ALTHOUGH it is realised by most readers that any distortion present in the radio set receiving the signals which are passed on to the television equipment is sure to mar the image, very few appear to differentiate between the several forms of possible distortion. One aspect which is neglected repeatedly concerns amplitude distortion, and this has a very particular application in the detector valve stage.

If consideration is given to the two most common methods of rectification it will be found that the grid leak and condenser form is more efficient at low input amplitudes and anode bend at high, the efficiencies being almost equal in the region of half a volt input. With ordinary grid rectification the results are very non-linear, that is to say there is not true proportionality between input signal voltage and output signal voltage for all amplitudes. It is for this reason that recourse is now so often made to what has come to be known as power grid rectification. The circuit constants and operating conditions are of quite a different character, and it will be noted that the time constant of the grid discharge circuit is less than for ordinary grid-leak working. It must also be borne in mind, however, that although anode-bend working is preferable, acute amplitude distortion is introduced by this method for low-voltage signal inputs.

To achieve optimum results with television signal reception it is very essential to preserve the different amplitudes in their correct relative proportions. It is for this reason that pure or linear rectification is as important as correct amplification. One device which provides this is the diode valve, while another unilateral conductor is the Westector, or even the oft-despised crystal. If preferred, a double-diode valve working in push-pull rectification can be used.



Short Wave Section

BROADCASTING FROM BALLOONS

A Suggested System of Ultra-short-wave Transmission.

By AUSTIN FORSYTH

THE probability of the eventual use of ultra-short waves for broadcasting and high-definition television, as envisaged in the technical press, raises interesting problems of propagation, the solution of which could be approached in several ways; some writers suggest a network of relay stations, each having a necessarily limited reliable service area owing to the so-called "quasi-optical" effect, these stations being linked, either by cable or micro-ray directional transmitters, to a central studio for control purposes.

Ultra-short waves

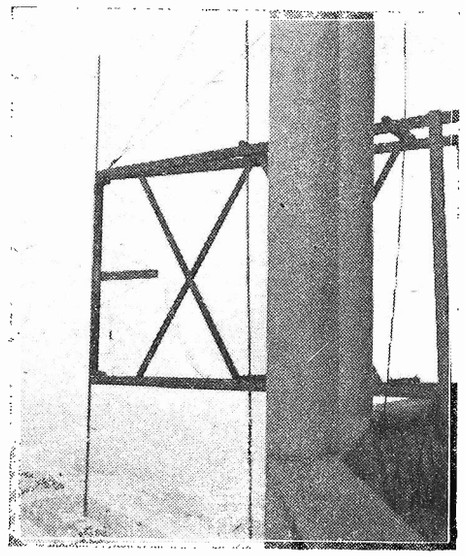
Now, there are certain factors connected with the propagation of waves of the order of 7 metres which would make the actual service range of any station entirely a matter of conjecture, especially in densely populated areas, such as the surroundings of London. In other words, while in fairly open country one of these ½-kW. stations might have a range well in excess of 15 miles (power-range limits which have been assumed), from actual experiments which have been carried out in built-up districts it is probable that the service area would be far less. In fact, the behaviour of ultra-short waves in such localities is quite unpredictable, and while they have tremendous penetrative power up to a mile or so—very strong signals being receivable with only a few watts input at the transmitter and under practically any conditions of screening, a five-fold increase in transmitter power making no appreciable difference to the strength of reception—outside what might be called this "effective range area" matters are very different. Places which might be supposed to give strong signals by reason of the topography very often yield none at all, while at others where one would not expect it reception is good. This erratic behaviour is of course due to the many obstructions in built-up areas, which produce unexpected reflecting and refracting effects on the waves. The extreme variation in signal strength from place to place in densely populated surroundings is well known and has often been encountered and described by many workers. Any attempt to produce signals in one of these "blind spots," say by altering the plane of the transmitting aerial, usually results in reception being lost somewhere else. In communication between two such points much can be done with simple reflecting systems, but this is obviously out of the question for broadcasting.

However, there is one method of propagation which, though it has not to the writer's knowledge been tried out in connection with the problem under discussion, seems to have great possibilities from the point of view of broadcasting, and more especially the enlarging of the service area.

Transmission from Balloons

This is transmission from a great height. Experimental data available seems to indicate that many of the difficulties associated with transmitters placed more or less at ground level disappear or are considerably reduced, signals from a comparatively low-powered transmitter being receivable with great strength and consisteney over a wide area. The idea in the writer's mind is that before any system of ultra-short-wave transmission, either for sound or high-definition television, is established through a network of relay stations, full-scale experiments might be tried from captive balloons flown at a considerable height. At first sight, this may appear a fantastic suggestion, but let us examine one method by which such tests could be carried out.

In the first place, all that would be required in the balloon would be the RF portion of the transmitter; that is, the oscillator, to which *modulated power would be supplied from the ground through cables*



The dipole ultra-short-wave transmitting aerial at the top of the Crystal Palace Tower, which radiated sound originally on 6.25 metres. A similar U. S. W. transmitter is also used for television experiments.

carried up on the balloon holding-cable, the idea being to reduce weight and keep the variables under control, since the power supply and modulating equipment would thus be on the ground. For a test under practical conditions, the transmitter could be a simple low-power self-excited oscillator of the push-pull tuned-plate, resonant-grid type operated at an input of 20 watts, the aerial being of conventional half-wave design, either trailing or fixed to the basket, the whole being made weather-proof and sent up to a height of, say, one mile, in a suitably designed balloon. The "basket" could be a light metal gondola, totally enclosing the transmitter, the aerial, which would only need to be a light metal rod eight feet long, being fixed outside and coupled to the oscillator by means of a simple feeder system.

All operational difficulties would be eliminated, since the oscillator, once tuned near ground level, would "stay put," while for inspection, testing and safety purposes, the balloon could be wound in at the end of each transmission period. The practical difficulties apparent in such a scheme are three: The danger from lightning, the loss of the balloon through gales, and the problem of supplying modulated power to the anodes of the oscillator valves through a long feeder line.

Taking the last first, this should not be insurmountable, having regard to the experience of Post Office and B.B.C. engineers in producing high-fidelity land-line transmissions and the correction of losses in long lines, though admittedly in this case the problem of line losses is a little different. The modulating power required would be higher than if modulator and oscillator were side by side, while a specially constructed feed line would have to be used. As regards the two first-named difficulties, the danger from lightning could be greatly minimised by effective earthing, while the possibility of losing the balloon and its load through gales could be prevented by good anchoring. Actual movement would not matter.

Advantages of the System

Whatever the difficulties and the means adopted to overcome them, it is certain that the service area and effective range of a transmitter installed under these conditions would be enormously increased in comparison with one at ground level, with a correspondingly large reduction in the cost of covering adequately an area such as the British Isles. It is probable, judging from the meagre information available from existing data that a certain effective height would be found giving the most convenient service area, while it also seems that at a critical height ultra-short wave signals propagated by this method would disappear in the area surrounding the plan position of the balloon-transmitter.

Remembering the successful low-power five-metre tests carried out by amateurs from aeroplanes and from Snowdon and the Malvern Hills, the writer suggests that the idea outlined presents a possible and reasonable method by which could be overcome the difficulties at present surrounding the establishment of national broadcasting and television services on the ultra-short waves.

THE EASY ROAD TO RADIO.

THE BEGINNER'S SUPPLEMENT

HOW WIRELESS WAVES ARE BENT.

In this Article the Author Deals with the Effects of the Heaviside and Appleton Layers.

WIRELESS waves are known to be identical with those that give rise to the sensation of light. Both are vibrations in the electro-magnetic ether, the only difference being one of size or—what amounts to the same thing—frequency.

The radio engineer is chiefly concerned with wavelengths of the order of hundreds or even thousands of metres, whilst the optician does not recognise any wave longer than the one-millionth part of a metre. This enormous disparity in size is responsible for certain rather puzzling differences in the behaviour of the two.

Light waves, for instance, always travel in a straight line, and in the ordinary way throw clear-cut shadows. Wireless waves, on the other hand, are able to bend round the curved surface of the earth. In fact, they can be made to complete the circuit of the earth, not once but several times in succession.

In the early days, scientists were inclined to pooh-pooh the possibility of sending wireless messages over really long distances due to earth curvature. However, when Marconi proved their fears to be ill-founded, by transmitting signals across the Atlantic, they naturally sought for some explanation of the "bending" of the waves. Heaviside in this country, and Kennelly in America, pointed out that an answer might be found by assuming the presence of a reflecting layer situated high above the limits of the ordinary atmosphere.

At the time, the suggestion was purely surmise, though the existence of at least two such zones of reflection has since been definitely established. The highest—or Appleton—layer serves to reflect those shorter waves which succeed in penetrating beyond the lower—or Heaviside—layer.

What happens to a train of waves meeting the layer can perhaps be explained by considering the case of a motor-car which is travelling along a road and suddenly runs into a patch of bad surface. Suppose in the first place that it meets a wide strip of soft sand, set diagonally across the road, so that one of the front wheels runs on to it before the other. Since the first wheel is, for the moment, forced to travel slower than the wheel still on hard ground, the car will tend to slew round, so as to face into the sand.

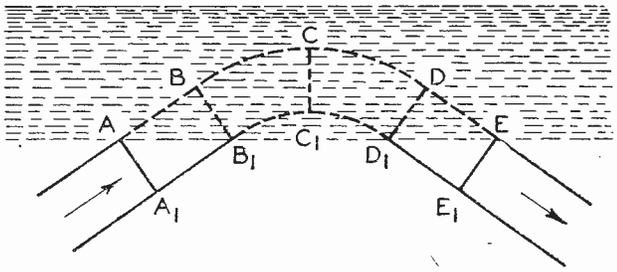


Fig. 1.—Showing how a wireless wave is refracted or bent by the Heaviside layer.

If, on the other hand, the bad patch is a wide strip of grease or oil, the wheel which strikes it first slithers faster than the wheel which is still subject to the frictional grip of the road, and the car then tends to turn bodily in the opposite direction. In both cases the twist is, in effect, a pivoting movement about the slower-moving wheel.

The Heaviside Layer

The Heaviside layer is a highly-ionised patch formed by the action of the fierce ultra-violet rays from the sun on the rarefied air existing at that altitude. Under the continual bombardment electrons are struck off from the atoms of air, and become free to move bodily over comparatively large distances. In addition the upper parts of the layer—where the direct action of the sun is most powerful—are more highly ionised than the lower parts.

Now, when wireless waves run into free electrons they increase their speed, and the effect becomes more pronounced as the density of ionisation increases. In other words, the Heaviside layer acts in very much the same way as a patch of grease on the wheels of a motor-car.

Consider, for instance, a wave front approaching the Heaviside layer at the angle indicated by the arrow in Fig. 1.

As the "leading-edge" of the wave meets the layer at the point A, its speed suddenly increases, so that it covers the distance from A to B in the same time as the slower-moving edge A1 reaches the point B1. The result is that the "front" of the wave begins to slew round from AA1 to BB1.

The upper edge B is now moving in a more highly-ionised part of the layer than the lower edge B1, so that it still travels a greater distance from B to C than the lower edge from B1 to C1; consequently the front of the wave C C1 is now moving parallel with the edges of the layer. The leading edge of the wave has meanwhile reached its maximum speed, and the "drag" of the lower edge begins to come into play, and turns the wave back through the stage D D1 until the lower edge emerges at D1 and starts its downward path to earth.

This presents a rough picture of what occurs when ether waves suffer refraction at the Heaviside layer. The effect, as described, applies more particularly to long waves than to short.

With short waves the action is more one of direct reflection—as light is reflected from a looking-glass. Here it is necessary to assume that the wave as it enters the layer sets the free electrons oscillating at its own frequency. The electrons then serve to re-radiate the wave downwards, in much the same way as any conductor, such as an aerial, will re-radiate if it is forced into oscillation by an incoming wave.

It is probable that the action of the Heaviside layer in every case consists partly of reflection and partly of refraction, the latter effect predominating in the case of the longer waves, and the former in the case of the shorter waves.

For waves shorter than 7 metres, both the Heaviside and Appleton layers appear to be transparent. Instead of being reflected back to earth, such waves simply pass straight through both layers and are lost in outer space. The same applies to waves which travel vertically upwards so that they meet the layer end on, so to speak. Similarly, if the angle of incidence is too abrupt, the layer is unable to twist the front of the wave

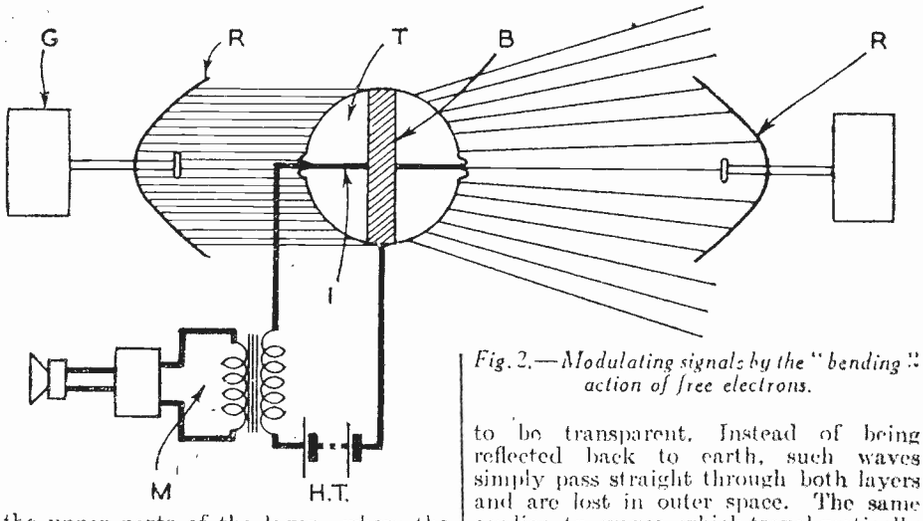


Fig. 2.—Modulating signals by the "bending" action of free electrons.

sufficiently to send it back to earth. For this reason transmitting aerials are usually designed to limit "high-angle radiation" to a minimum.

Short-wave Signalling

An interesting application of the effect of free electrons on a wireless wave has recently been developed in connection with short-wave signalling.

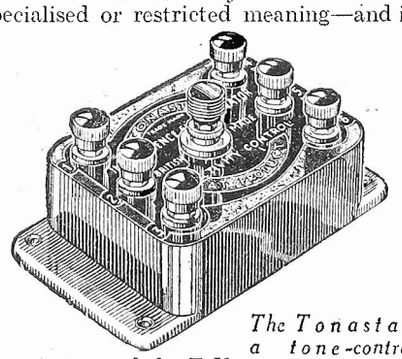
As shown in Fig. 2, a gas-filled tube T is placed in the path of a beam of "centimetre" waves, and is used as an "artificial Heaviside layer" to modulate the beam. A direct current is first applied to the tube from a high-tension source—H.T.—to produce a cloud of free electrons. The density and distribution of the electrons produced inside the tube is regulated by the internal electrode I and an external band electrode B.

The voltage on the tube T is first adjusted so that the electron "lens" exerts a steady refracting effect on the beam of waves transmitted from the generator G and reflector R. Microphone signals from M are then superposed across the two electrodes I, B of the tube, as shown.

The extra signal voltage causes the electron cloud inside the tube to fluctuate in shape. The varying "lens" effect, in turn, alters the concentration of the beam emerging from the tube, and the resulting changes in amplitude are detected by the distant receiver R.

COMMON MISCONCEPTIONS

AS season succeeds season, new devices in radio reception are developed, so that there is built up gradually a technique of ever-increasing complexity. Add to this the fact that the names given to these new devices are very often conceived in the laboratory—when the name is apt to be misleading, since technicians are very prone to use ordinary words with a specialised or restricted meaning—and it



The Tonastat, a tone-control device made by T.X. Products Co.

is not surprising, therefore, that listeners all too frequently fail to realise the real significance of various technical devices, and often expect from them results which are frankly impossible.

A.V.C.

To take a few outstanding examples, the device known as automatic volume control (A.V.C.) is probably the most frequently misunderstood. The general impression formed by many listeners is that a set equipped with automatic volume control will reproduce all stations at equal volume, by *increasing* the amplification when the set is tuned in to a weak station. The actual facts, however, are very different. Every set has a very different maximum degree of sensitivity and can only amplify signals to that extent. Automatic volume control operates by permitting the receiver to function at maximum sensitivity on weak signals, and by *reducing* the amplification of strong signals so as to achieve a more nearly uniform volume level for all stations normally receivable.

This means that, dependent upon the setting of the manual volume control, no programme, however powerful, will be reproduced at anything greater than the predetermined level of volume. It does not mean, however, that every station will be brought up to this volume.

Because the A.V.C. functions by passing back the rectified carrier voltage as additional or controlling bias to the variable-mu, high-frequency, and intermediate-frequency valves, a certain amount of "control" or reduction of volume will be exercised on every signal, weak or strong, with the simplest forms of A.V.C. With what is known as "delayed A.V.C.," however, control is only applied to signals above a certain strength, so that those signals which are weaker are amplified to the fullest extent permitted by the manual control setting.

An Example

A simple numerical example will make this clear. Suppose the maximum amplifying power of a certain set is represented by the figure 100. Then a signal of strength 1 will be amplified to strength 100; a signal of strength 2 will be amplified to strength 200; and a signal of strength ½ will be amplified only to strength 50. Now imagine the set to be fitted with A.V.C. and also with a manual volume control. We will assume that the manual control is set for a normal volume level of, say, 200. A signal of strength 2 would reach the predetermined level without calling the A.V.C. features into play. For signals stronger than 2 units the amplification would, however, be reduced automatically to limit the volume to 200.

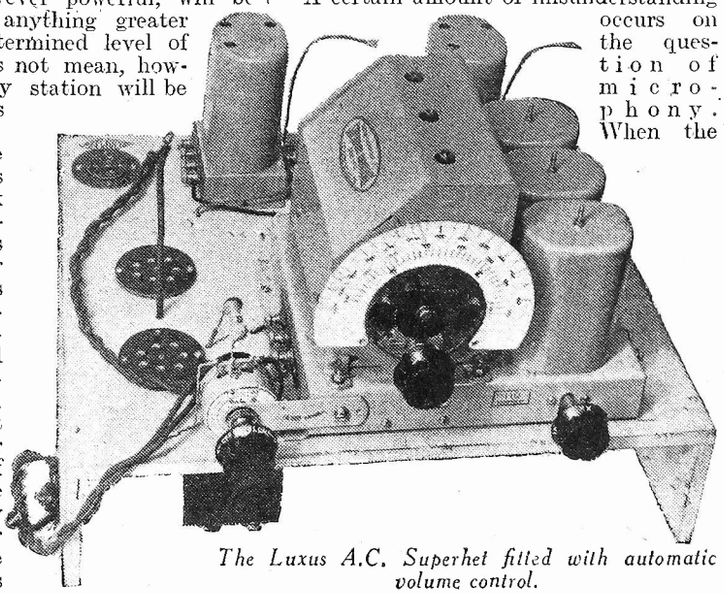
For example, when a signal of strength 4 is tuned in, the amplification will be lowered automatically to 50, which will give a volume of 200. But a signal of strength 1 can still only be amplified up to strength 100, and a signal of strength ½ only up to strength 50.

In some sets a further device is included which will silence all signals which cannot be reproduced at reasonably good volume. This is achieved by using an additional diode element, which is suitably biased to "mute" the low-frequency amplifier unless a signal above a certain strength is being received.

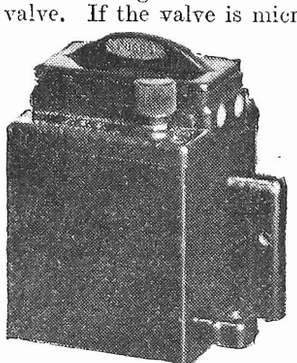
Another misconception concerning A.V.C. is that it is a complete and certain cure for fading. A.V.C. can and does reduce the effects of certain forms of fading—more particularly the slow type, when the signal gradually weakens and then gradually returns to normal. A.V.C. cannot, however, do much to counteract rapid fading, nor can it bring signals up to maximum volume when they have faded below a certain minimum value.

Microphony Misunderstood

A certain amount of misunderstanding occurs on the question of microphony. When the listener hears a continuous note in the speaker, which rapidly grows louder and louder without changing pitch, he immediately diagnoses microphony and puts it down to a faulty valve. Many readers of PRACTICAL WIRELESS know that in most cases microphony is the result of vibration of the electrodes of one or more of the valves in the receiver; but it does not always follow that when the trouble arises one of the valves is inherently microphonic. As a matter of fact, most modern valves are commendably free from inherent microphony. The prime cause of microphony is, of course, vibration, and usually vibration is caused by the speaker. In most instances audio-frequency vibration from this source is transmitted to the valve either through the chassis to the valve-holder and thence to the valve pins, or else through the air to the bulb of the valve. If the valve is microphonic, that is, if its electrodes are capable of movement, they, too, will vibrate and the sensitivity of the valve will sustain rhythmic variations so that certain notes will be



The Luxus A.C. Superhet fitted with automatic volume control.



A T.C.C. interference suppressor.

(Continued on page 625)

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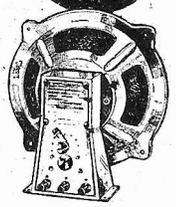

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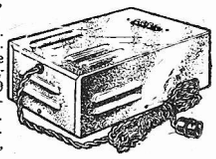

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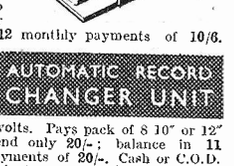

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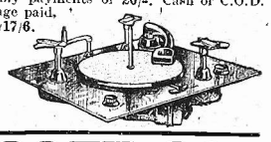

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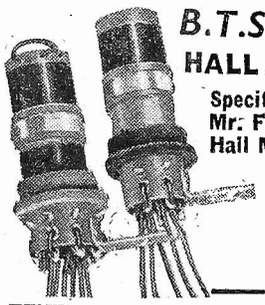

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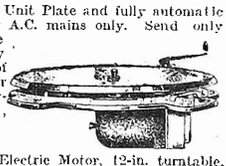

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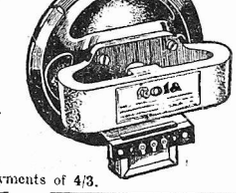

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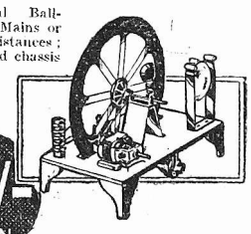

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By H. J. BARTON CHAPPLE, B.Sc., A.M.I.E.E.

WHEN it is desired to have television images which are extremely bright (relatively speaking), it is necessary to depart from the simple neon lamps and utilise light sources which are intrinsically brilliant. These can be modulated direct by the incoming television signals as, for example, in the case of the new Ti lamp which has a mercury vapour content, or alternatively the source of light can be maintained at a constant intrinsic brilliance, and the resultant beam of light modulated by means of a "valve," the most common form of which is the commercial type of Kerr cell, as illustrated in Fig. 1. This cell has to work in conjunction with a pair of correctly orientated Nicol prisms, but the mode of action is not the prime consideration at the moment. These notes have been compiled to stress certain important features in connection with the incandescent lamps which are used in the complete cell unit.

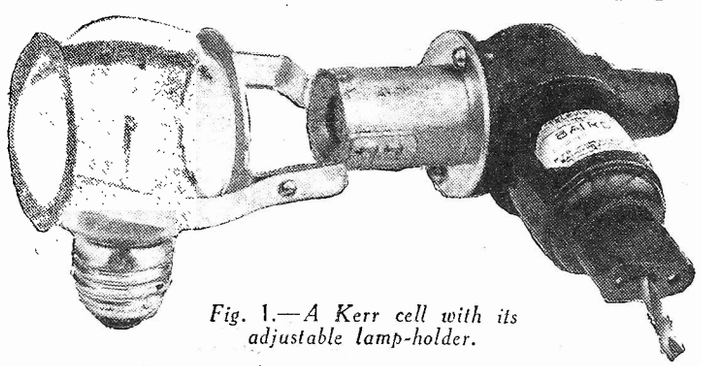


Fig. 1.—A Kerr cell with its adjustable lamp-holder.

For home receiver working, lamps having a wattage of 100 are a popular type. As a general rule they are of the 12-volt variety requiring, therefore, a current of 8½ amps. when run at their full rating. A lamp of this character is shown in Fig. 1, and the circular glass envelope has the filament mounted at its centre. This filament is wound in the form of a closely-spaced spring which is then held at the top of two vertical metal supports so that there are two or three loops. The resultant light from the 100-watt dissipation is therefore concentrated within a very narrow compass—a prime requirement in this type of television receiver.

Lamp Positioning

To obtain maximum efficiency from this class of lamp and incidentally increase the hours of useful life obtained from it, certain points must be given due care and attention. First of all, it must be used in the vertical position as illustrated. If the metal supports of the filament are horizontal with one support vertically below the other, the intense heat from the filament will rapidly affect them, and cause the metal to bend and the filament to sag. In addition, with a horizontal positioning of the supports it is almost impossible to focus the light correctly, owing to the shadow cast by the supports on the back of the glass envelope. The only correct method of positioning the lamp with reference to the Kerr cell Nicol prism combination is to have the vertical plane of the two supports at right angles to the optical axis of the prisms, the light beam being directed along this axis by placing in front of it a small diameter and short focal length condenser lens.

Ventilation

To prevent loss of light the lamp must be enclosed in some form of box which is bright on the inside to give suitable light reflection, and black on the outside to dissipate the generated heat. Another essential feature is the provision of adequate ventilation to keep the lamp as cool as possible. One method of carrying this out efficiently when employing a mirror drum scanner is to use the shaped box container seen in Fig. 2. The two vertical sides converge towards the front, while the top is shaped to have the same curvature as the drum periphery, the drum itself revolving above the box. As the drum rotates it forces a current of air into shaped flutes cut in the box top. This air circulates round the lamp and escapes from circular hole vents in the back cover.

A Suitable Connector

The next point to consider is the method of making electrical connection to the lamp itself. As a rule, these lamps have a screwed base similar to a flash-lamp bulb, and are sold without a holder. Allowance must be made for lamp movement for focusing purposes, and many users, therefore, just solder two leads in place—one to the outer screwed shank and the second to the metal projection at the bottom. Remember that these leads, in addition to being flexible, must be of the correct current-carrying capacity (8½ amps. in the case of the 12-volt 100-watt variety). Single cab-tyre flex is admirably suited to the job, but when soldering the leads remember not to overheat the lamp shank, or the lamp itself may be damaged.

Another alternative is to use a screwed form of bayonet holder, but as these are usually cumbersome, with a large porcelain fitment, the user may prefer to make up his own connector. One scheme consists of a brass strap screwed to an ebonite distance piece. By adjusting the screw tension on the strap at the end remote from the ebonite, the lamp may be turned at will. A spring leaf attached to the bottom of the ebonite serves to make contact with the stud at the lamp base, and the wire flex can be held in place under the screw heads.

For feeding the lamp with its correct voltage and current an A.C. mains transformer can be used, or, if preferred, heavy-capacity accumulators.

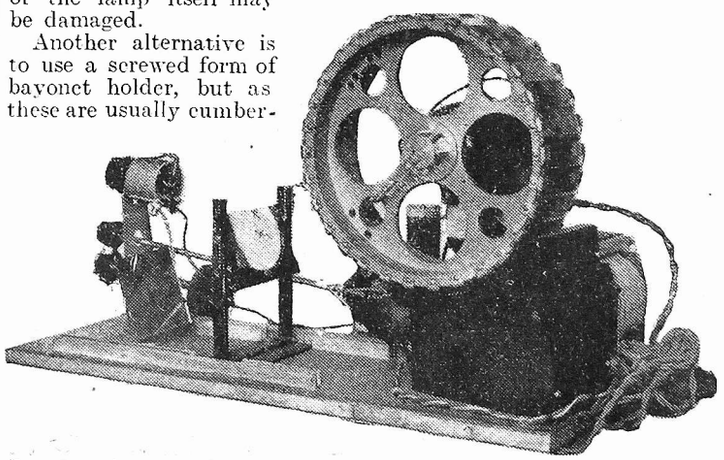


Fig. 2.—A mirror-drum scanner with a shaped box which provides adequate ventilation for the lamp.

SYNCHRONISING WITH A.C. MAINS

THE 30-toothed wheel method of synchronisation is too well known now to need any detailed description; however, a recent modification of this scheme appears to have many possibilities and advantages, and is somewhat simpler in application.

Use is made of 50-cycle A.C. mains. The synchronising coils are designed to withstand the full mains voltage across them; the phonic wheel having only 8 teeth for present 30-line transmissions.

The advantage of this method appears to lie in the fact that greater "pull" can be obtained on the cogged wheel (depending on the design of the electromagnet) and consequently maintaining a very constant motor speed.

The system functions entirely independently of the received signal from the transmitter. It might be said that 100 per cent. synchronisation cannot be obtained unless both receiver and transmitter are using the same mains supply; this, of course, is perfectly true.

If, in the future, television developed on the ultra-short-waves—such as the recent 6-metre transmissions from the Crystal Palace—and stations were set up in various parts of the country, it would be quite practical to expect that both transmitter and receiver could be on the same mains supply, owing to the limited range of transmission on these frequencies.

For the experimenter who wishes to try a mains synchroniser, it may be of interest to note that standard type synchronising coils can be used, the two leads from the coils being taken direct to the mains supply.

It is an advantage to insert a quick make and break type of on-off switch in one of the leads.

The motor should be switched on ten minutes or so before the actual transmission starts, and the speed adjusted by means of the usual motor resistance until 750 revolutions per minute is reached—as indicated by the lines on a stroboscope disc. The synchroniser is then switched in.

COMMON MISCONCEPTIONS

(*Continued from page 622*)

unduly amplified and re-amplified, producing the well-known audible effect.

Microphony can, however, sometimes be developed even though the valves are perfectly innocent. Instances have occurred in which variable condenser vanes have been set in vibration by the loud-speaker and the rhythmic changes thus produced in the tuning of circuits have then been amplified by the normal action of the receiver, resulting in a microphonic note.

Tone Correction

A large number of listeners fondly imagine that the various tone correction devices and tone controls that are fitted to many sets improve the fidelity of reproduction. Actually, they do nothing of the sort. Departures from perfect fidelity are mostly due to losses of certain audio frequencies—usually it is the treble notes which are "cut." Sometimes, of course, undesirable resonances are added. No tone correction can put back what has been taken away. All that can be done is to suppress or partly suppress those frequencies which, owing to losses in other directions, are now unduly prominent. Judiciously applied, tone correction does make reproduction more pleasant, and can also be used to change the character of the reproduction to suit individual tastes.

Finally, extremely hazy notions exist in many quarters concerning the effectiveness of devices for avoiding "man-made static" or, in other words, interference due to industrial or household electrical apparatus. Shielded aerial down lead wires, mains filters, and similar apparatus are widely recommended, and, up to a point, are successful. But they have their limitations.

Interference

Interferences of this type may be radiated from their source and collected by the aerial, the down lead, or the earth wire. They may also circulate in the electric wiring and pass into the set *via* the mains unit. Radiated interference cannot be avoided simply by using a screened lead-in, unless the main portion of the aerial is outside the interference zone.

Similarly, a mains filter installed at the point where the mains enter the set cannot prevent any interference *radiated* from the household electrical system—it is only effective in preventing mains-borne interference from entering the set. Then, a filter installed where the mains enter the house will only prevent mains-borne interference from reaching the house wiring. It will not avoid interference radiated from neighbouring premises or other external sources.

It would appear, therefore, that the most complete protection would comprise an outside aerial removed as far as possible from all sources of interference, and with a screened lead to carry the signal through the interference zone to the set and to avoid pick-up from the domestic installation, plus a filter at the mains input to the receiver to avoid mains-borne interference.

Even these, however, will not give complete protection, and the only real solution is to tackle all interference at its source and to prevent its generation and propagation.

(Continued from previous page)

current requirements, since these may be greater than the rectifier can supply. This is evident when it is observed that the 41 MP valve takes only 24 milliamps, as compared with the 40 milliamps required by the 41 MXP.

Directly-heated Valves

The directly-heated valves can now be considered, starting with the "smallest" of those listed, the Cossor 4XP, which has an output of 1,000 milliwatts (1 watt) and passes an average anode current of 45 milliamps. This valve has a 4-volt filament, but this takes only .6 amp. It can be fed from the same transformer winding as that used to supply the heaters of preceding valves, when it should be connected as shown in Fig. 1, or it may be fed from a separate L.T. winding, as shown in Fig. 2. The value of the bias resistance is the same in both cases, although it is connected differently. This particular valve, however, is particularly suitable for use in a push-pull circuit following an intermediate L.F. stage, including an indirectly-heated valve of the L.F. type. The push-pull arrangement is shown in Fig. 3.

The Osram PX4 valve is a very popular directly-heated output valve for use when a large undistorted output is required. It has a maximum output of 2½ watts, combined with a comparatively low amplification factor, which means that it should be preceded by at least one stage of L.F. amplification or, when "quality" is the chief consideration, by two R.C.C. stages. This valve is one of the largest available for operation with an H.T. voltage of 200 to 250. Because of this the valve can frequently be employed in a mains receiver in which a Class A (250 volt, 60 m.a.) rectifier is fitted, although, in order to supply the valve with the maximum H.T. voltage of 250, as well as with the necessary 34 volts grid bias, a 350-volt rectifier is to be preferred. The PX4 can be used in any of the circuits shown in Figs. 1, 2 and 3 provided that the bias resistance is of the correct value. It is very well suited to a push-pull circuit when a large output is required, and it is extremely valuable when the set has to be fed from D.C. mains of standard voltage.

For Five-watts Output

The "largest" valve of which data is given in the accompanying panel is the Mullard DO 24, and this gives an output of 5 watts, for an H.T. current consumption of only 63 milliamps; the H.T. voltage required, however, is 400, so that a Class C (500 volt) rectifier is necessary for its correct operation. A special point concerning this valve is that it has an amplification factor of 10. Because of this, the valve will give the full output of 5 watts with an input of little more than that required to load the "smaller" directly-heated valves referred to above. This is an important point when great output is required from a receiver having only about four valves, or from a simple type of gramophone or public-address amplifier. The valve should always be preceded by at least one high-amplification L.F. stage, whilst it is generally better to employ two stages, each of which gives a moderate degree of amplification.

MULLARD DO 24

Filament Voltage	4
Filament Current	2 *amps*
Max. Anode Voltage	400
Optimum Load (*At Anode Volts* 100; *Grid Volts Zero.*)	4,000 *ohms*
Anode Impedance	1,390 *ohms.*
Amplification Factor	9
Mutual Conductance	6.5 *m.a./v*
Undistorted Output	5,000 *m.W.*
Bias Resistance	540 *ohms*

OSRAM PX4

Filament Volts	4
Filament Current	0.6 *amp*
Amplification Factor	3.5
Impedance (*Measured about Anode Volts* 100, *and Grid Volts* 0)	1,050 *ohms*
Mutual Conductance	3.3
Anode Volts	200 *max.*
Undistorted Output	2,500 *m.W.*
Bias Resistance	750 *ohms*

In the case of all power-output valves whose anode current is in excess of about 25 milliamps, it is advisable that the speaker should be fed through a choke-capacity filter, as shown in the circuits given, and it is often desirable, especially with valves having a high amplification factor (such as the DO 24, for example) to include a fixed resistance of about 100 ohms in the anode circuit between the anode and the output choke. The object of this resistance is to prevent L.F. oscillation which might otherwise occur.

The Bias Resistance

The correct values of bias resistance are given for the valves listed, but as readers will often use similar valves to those mentioned above, and for which the correct bias resistance is not known, it might be desirable to explain the method of calculating the correct value. The method is to divide the grid-bias voltage required by the rated average anode current and multiply the result by 1,000. For example, the Cossor 4XP requires 23 volts G.B. and passes an anode current of 45 milliamps, so that the resistance value is 23/45 times 1,000, or almost exactly 500 ohms, as shown. The resistance must always be capable of carrying the full current without over-heating, and attention must therefore be paid to the wattage rating. The watts to be dissipated by the resistance can be found by multiplying the voltage dropped (G.B. voltage) by the current passed (anode current) and dividing by 1,000. For example, the resistance just considered should have a rating of 23 times 45 over 1,000, or just over 1 watt; a 1½-watt resistance would be chosen in this case. The decoupling resistances shown in the circuits Fig. 1, 2 and 3 are not always necessary, but should be used if any instability is experienced; they have no current to carry and can be 1-watt, or even ½-watt components.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to: "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

FULLER BATTERIES

A RECENT folder issued by Fuller Accumulator Coy., Ltd., deals with "Inert" high- and low-tension batteries. The range has been designed chiefly for use overseas, but such batteries will also have a definite appeal to wireless users in remote areas, where mains and charging facilities are not available. The Fuller "Inert" High-tension Battery is a modified form of dry cell, capable of being stored for unlimited periods without deterioration. The battery remains inert until water is added to make the cells active. These batteries are made for varying voltages from 60 to 120. The low-tension "inert" battery is designed to take the place of the usual 2-volt accumulator, and both types of battery are housed in strong wooden boxes. Replacement cells are obtainable, and the prices for these, as well as the complete batteries, are given in the folder.

PIX PRODUCTS

FULL details of the Pix Invisible Aerial are given in a new leaflet just issued by the British Pix Coy., Ltd. This aerial, which is in the form of a narrow adhesive fabric strip carrying an insulated aluminium conductor, can be quickly attached in any desired position. It can also be used as a counterpoise earth. Among the other items included in the leaflet are a range of Pix valves, the Pix Metallised Earth, the Modula Armchair Control, and the Pix Lightning Arrestor.

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 CROYDON RADIO SOCIETY

THE Croydon Radio Society's first meeting of 1935 took place on Tuesday, January 1st, in St. Peter's Hut, S. Croydon. The lecturer was Mr. G. A. Briggs, who spoke on "Modern Loud-speaker Practice." He had some provocative things to say, maintaining at the start, for instance, that most people cannot judge a loud-speaker's performance. After all, there was no standard of sound like there was for vision, as if our eyesight became indistinct, spectacles could be prescribed and objects brought into the desired standard focus.

Indeed, we would never get ideal reproduction, inasmuch as it was similar to a photograph or the talkies, and both these so-called arts were really nothing more than just pictorial representations of the original. Dealing with a loud-speaker's construction, Mr. Briggs said that to-day the permanent magnet was as good as an energised model, the flux density being the all-important factor. He demonstrated three "Wharfedale" speakers of different flux densities. Also included were many illuminating views on reproduction, and Mr. Briggs scorned the use of a 10in. cone for good bass response, as a 5in. one could reproduce a 50-cycle note with a good baffle.

On January 22nd the Society visits the Thornton Heath Society for a talk by the hon. secretary of the Television Society, and on January 29th, at St. Peter's Hall, a dual loud-speaker night takes place.—Hon. Secretary: E. L. CUMBERS, Maycourt, Campden Rd., S. Croydon.

SHORT-WAVE RADIO AND TELEVISION SOCIETY (THORNTON HEATH)

A MEETING of this Society was held at St. Paul's Hall, Norfolk Road, on Tuesday, January 1st, when Mr. Musset, of The Union Radio Co., Ltd., gave a talk and demonstration on the Unirad Short-wave Converter. Mr. Hoare first gave a demonstration of the Ferranti Arcadia Model. Mr. Musset then continued with a description of the short-wave converter. The set covers a range of 13-55 metres and is designed for A.C. operation on 100/130v. and 200/250v., 40/100 cycles mains. The first stage is a pre-selector and employs an H.F. pentode. The second is a combined first detector and oscillator. The intermediate frequency thus produced is passed on to the broadcast receiver through a screened lead. This stops any tendency for medium-wave break-through on the short waves. The converter was afterwards demonstrated to members and several American and other stations were tuned in.

Random Jottings

By JACE

Far From the Madding Crowd

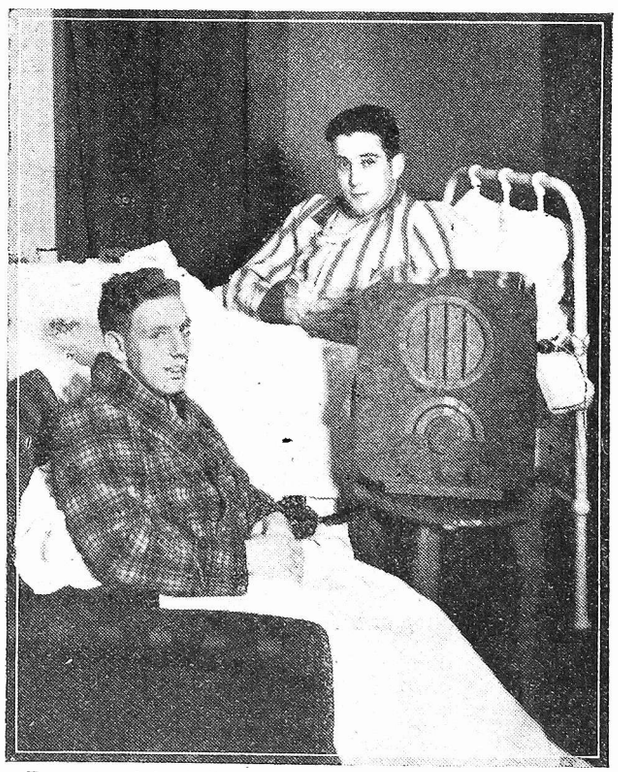
TWO injured Tottenham Hotspur footballers, Arthur Rowe (captain) and Billy Hall, centre-half and inside-left respectively, who are seen in the illustration on this page, heard their radio programmes through a six-year-old portable until a modern Ekco superhet was installed at their nursing home just in time for the Christmas programmes. Instead of receiving one programme—"two if we turn it round"—they soon had a choice of forty or fifty stations at full speaker strength.

Marconiphone Visual Tuning Apparatus

ALL Marconiphone users are by now familiar with the two little arrows pointing in opposite directions, with their shafts becoming more and more elongated and approaching one another more closely as the set becomes in tune with a particular radio transmitting station. This visual tuning apparatus fulfils a twofold purpose, inasmuch as it is a ready means of telling when the instrument is in tune, and is therefore invaluable to the layman, and also—and this reason is by far the more important—absolutely faithful reproduction is assured when the set is tuned properly to a station.

Perhaps more blame is levelled at radio receivers for bad reproduction without this tuning device than for any other reason. The ordinary user without any technical knowledge whatever tunes his set until he hears something; if the reproduction is not good, he immediately blames the instrument, whereas the turning of the tuning knob perhaps a shade in one direction or the other would ensure accurate tuning and consequently distortionless reproduction.

The whys and the wherefores of this tuning device were explained to visitors to the Physical Society's recent Exhibition. The demonstration was carried out with the help of the current Marconiphone Radio-gramophone Model "289"; its chassis was used to tune the device exhibited, and was fed along a screened lead by a small local transmitter situated some distance away.



Two injured footballers enjoying a radio programme with a new Ekco superhet. The receiver is the model 95—nine-stage A.C./D.C. transportable, and is priced at 15 guineas.

Radio Communication with Fishing Vessels

THE French Minister for Posts, Telephones and Telegraphs has given shipowners permission to establish telephonic communication with their ships at sea, a Philips Press Service message states. Transmitters on the coast will be permitted as well as on the vessels; one such, in fact, has already been put into use in the harbour of Arcachon.

Loud-speakers as Teachers

NO fewer than 30,000 municipalities in France have decided to buy radio sets for use in schools; while a recent municipal ordinance by the city council of Berne has made loud-speakers compulsory in all the schools of the town.

Radio Telephony in Iceland

WE learn that the Icelandic Government has granted a concession for the installation of a short-wave transmitter near Reykjavik, which will shortly be used for telephonic communication.

Radio Underground

A RADIO set has been installed at the "Metro" underground railway station at Chatelet, Paris, to beguile the vigil of prospective straphangers.

80,000 Amateur Transmitters

THERE are no fewer than 80,000 amateur transmitters in various parts of the world, according to an Austrian expert. This authority also stresses the value of radio communication to governments and forecasts the loosening of the official regulations which handicap amateurs.

What Listeners Want

IN a recent article George Bernard Shaw said that all men are 99.9 per cent. alike. If this were really so, there would be almost complete unanimity on the question of which is the ideal radio receiver, and the hundreds of different models now on the market would have but small sales. The survival of so many types of receivers, however, indicates that listeners in bulk have very varied requirements, and suggests that Mr. Shaw has somewhat over-estimated the extent to which humanity is a standardised product.

The great mass of listeners to-day differ from the residue of the early clan of radio fans primarily in that they demand radio entertainment first and foremost, rather than the passing thrill of hearing obscure and distorted foreigners. By "entertainment" they usually mean realistic reproduction at comfortable volume, combined with the ability to receive the British transmissions, and also a good selection of Continental capital stations having real programme value. The second difference between the present-day listener and the old stager is that the utmost simplicity of operation is now demanded in place of the technical complications and fearsome array of knobs which characterised the early receiver. A switch, a simple volume control, and one tuning knob represents the normal listener's idea of control gear.

It is interesting to note how all these ideas are interpreted in typical modern receivers. The problems have been recently tackled anew by the Mullard Wireless Service Co., Ltd., who have this season produced their first complete receiver. In this set, which is known as the "M.B. Three," technical performance as represented by "sensitivity" (range) and "selectivity" (ability to receive programmes free from interference), is achieved by the use of three pentode valves, one for high-frequency amplification, one for detection, and one for output. Entertainment value is guaranteed by the careful design of the circuit, and the use of a sensitive moving-coil speaker accurately matched to the output valve. The utmost simplicity of control is achieved by avoiding the device known as "reaction" and by careful adjustment of the circuit components so that the tuning controls are accurately matched or "ganged" for operation by a single tuning knob. Moreover, this accuracy in manufacture and adjustment ensures that the tuning dial, which is graduated in wavelengths, is very accurately calibrated so that stations can be immediately identified when they are tuned in. Actually there are only two knobs on this receiver; the tuning knob already referred to also operates the wave-change switch, and the second knob actuates the battery switch and also the volume control. The cabinet is of inlaid walnut, of horizontal shape, and with a simple yet pleasing design for the fret of the loud-speaker opening. The "M.B. Three" is a battery-operated set, and a good combined high-tension and grid-bias battery and low-tension accumulator are included in the price, which is £8 8s.

A Durable Earth Lead

THE choice of material for the earth lead is often made on a purely electrical basis, such points as high conductivity, easy soldering, and so on, being the only ones to receive consideration. This may prove satisfactory in most cases, but there is a certain situation in which the decision arrived at in this way is not necessarily the best one. I refer to the by no means uncommon combination of an earth lead to a buried plate or tube in a flower bed, and an over-enthusiastic gardener. In such circumstances the lead is apt to receive many a blow from a spade or hoe, and few of the ordinary materials will stand this treatment for long.

I have had occasion to study the problem for some little time, and have now discovered a form of cable which seems able to repel all attacks with the greatest of ease, and which also possesses excellent electrical properties. This invaluable material is the armoured cable used for wiring the lighting circuits on motor-cars, and it can be obtained from most garages. It is somewhat expensive, but one needs only a few yards, and I imagine that those who have been puzzled once or twice by the behaviour of their sets when the earth has carried away will think the security which it gives very cheap at the price!

Inside the armouring this cable contains various layers of rubber or gutta percha insulation, and the conductor itself takes the form of finely stranded copper; this must receive a little protection where it is bared for the connection to the earth tube, since the strands are thin enough to suffer from corrosion unless something is done to prevent it. I find it a good plan to make the actual connection by soldering, and then run melted Chatterton's Compound over all the exposed strands. Probably a dab of tar would answer the purpose equally well.

PRACTICAL LETTERS FROM READERS

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

Mains Version of the "Hall-mark Three"

SIR,—Many thanks for a pleasant evening each week perusing PRACTICAL WIRELESS. I have been very much intrigued with the "Hall-mark" Three. Do you contemplate an all-mains version? If so, please do not forget those who already have a mains H.T. unit and who would like to do away with the L.T. battery. In other words carry on with your policy of high-grade receivers at the minimum of cost.—H. W. (Birkenhead).

[*A blue print for such a receiver will be given FREE with next week's issue.*—ED.]

A 2 H.F., A.V.C. Receiver

SIR,—I wish to add my support for a 2 H.F., A.V.C. receiver.

In my opinion, a circuit of this nature can be superior in range to a superhet (which has no H.F. stage preceding its first detector) with a definite improvement in quality.

Also, I have little faith in valves designed to fulfil more than one purpose, and for this reason my arrangement would be: 2 V.M. pentodes, diode-tetrode (such as the Mullard S.D.4) for detection and A.V.C., R.C. coupling to first L.F., R.C. coupling to output triode.

I should further suggest an output of 4 to 6 watts, and the power pack and amplifier being separate to the H.F. portion.

As far as I am concerned, I should like to see a design in your excellent pages for the H.F. portion only, telling your readers the precise H.T. voltage and the m/ampere consumption, so that we can adjust our existing amplifiers for it.

This last item is prompted by the fact that most readers who have written on this subject appear to have an amplifier.

One other point occurs to me: choosing the coils and condenser so that the latter can be obtained with a dial calibrated in wavelengths.

Some form of tuning indicator would also be a valuable refinement.—S. S. (West Twyford).

A Marvel of Modern Journalism

SIR,—I appreciate very much the good "fare" you give your readers each week in PRACTICAL WIRELESS. This weekly has been my "wireless educator" ever since No. 1 appeared, and I have kept handy every issue since then for reference.

Your being able to provide week by week such a wealth of fresh ideas is, to me, a marvel of modern journalism.

I was fortunate enough to win a prize in the recent "Buy British Competition" and so I found myself over the Christmas holidays with a new set of excellent valves. The problem was how best to use these valves. Eventually I decided to replace the detector and power valves in my set, leave in the screened grid, and to add another stage of H.F.

PRACTICAL WIRELESS (Dec. 15th) very conveniently provided the circuit for the amplifier. When this had been built and connected up I saw at once that there was going to be a real "Radio Christmas" for me. The sensitivity and selectivity of my set were materially improved and I have been able to tune in two American stations on the medium waves—I have tried many times before but always failed.

Here is a suggestion. Could you not make greater use of formulæ and numerical examples in series like "Half-Hour Experiments" and "The Beginner's Supplement"? To take an example: I am sure that many of your readers would like to know exactly how the values .05 mfd. and 100,000 ohms are arrived at in designing the tone control given on page 471 of the Dec. 15th issue. With your genius for elucidation I think you could do this without becoming too scientific.—H. W. (Cardiff).

[*What do other readers think of the above suggestion?*—ED.]

Our "Television and Short-wave Handbook"

SIR,—I must thank you for your "Television and Short-Wave Handbook." I got your other book, but this one seems to be even better, as it is going to be nothing else in a while but short waves. Well, I did not know much about short waves, but by your book I have got six months' teaching in a fortnight. I am a regular reader of your paper.—JAMES TAIT (Glasgow).

CUT THIS OUT EACH WEEK.

Do you know

—THAT when using a smoothing choke in the negative lead it is often better to connect the earth lead direct to the H.T. negative?
—THAT hum is often introduced by leaving the earth connection in the normal position in the circuit?
—THAT more thorough decoupling is necessary when using an eliminator than when feeding a set from an H.T. battery?
—THAT a low-priced A.C. receiver with push-pull output is to be described in PRACTICAL WIRELESS next week?
—THAT L.F. oscillation can frequently be cured by reversing the leads to the secondary winding of the L.F. transformer?
—THAT a combination valve is now available which has three diode sections as well as a triode L.F. assembly?
—THAT instability in push-pull amplifiers can nearly always be overcome by using a double centre-tapped input transformer?
—THAT the output available from two valves connected in push-pull is nearly two-and-a-half times that obtainable from one of the valves used in an ordinary circuit?

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL 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 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.

A REVIEW OF THE LATEST RECORDS

IMPRESSIONS ON THE WAX

By T. Onearm

THE twelfth medley by that popular pianist Charlie Kunz makes its appearance in the British Homophone Company's list, released this month. This record, *Sterno* 1560, introduces "Smoke Gets in Your Eyes" (which is very popular at the moment), "Vilia," "Who Made Little Boy Blue?" "Lights Are Low," "Stars Fell on Alabama," and "Life is Just a Bowl of Cherries." Each tune is played in that charming style which this artist has made so popular. Don't miss this record!

This month the Casani Club Orchestra have taken all of their numbers from the latest films. Their first two numbers, "What a Little Moonlight Can Do," and "Don't You Cry When You Say Good-bye," are from the film "Road House," and are recorded on *Sterno* 1551, and their other record, *Sterno* 1552, introduces "If I Had a Million Dollars," and "What Diff'rence a Day Made," from the film "Transatlantic Merry-Go-Round." They are all lively dance tunes—perfectly played.

Sydney Lipton has recorded four splendid tunes for January—all brilliantly orchestrated and recorded with that perfect artistry that is always found in records by the New Grosvenor House Band. "The Continental" from the film "Gay Divorce," and "Who Killed Cock Robin?" on *Sterno* 1553 is exceedingly good.

Billy Merrin and his Commanders—a band well known to Midland Regional listeners—reproduce four of their most successful items this month on *Sterno* 1555 and *Sterno* 1556 respectively. The first, "With Every Breath I Take" from the film "Here in My Heart," and "Who's Been Polishing the Sun?" from the film "The Camels are Coming," are typical of this orchestra.

A New Combination

J. B. Cuvelier's International Novelty Band, which has recently come into prominence, make a clever record this month on *Sterno* 1557. This record introduces "Does it Matter to You?" and "Passing Clouds." These alluring melodies by this new novelty combination are sure to appeal to everyone who likes real catchy tunes mingled with dance music.

"Pal o' Mine" and "Can I Be Sure of You?" on *Sterno* 1559, are two delightful songs of the light type, performed by Edward Molloy, who has a voice ideally suited to this class of song. Both have lovely refrains, and altogether this is a most attractive record.

Those readers who like light music will certainly appreciate *Sterno* 1558 on which Reginald King and his orchestra play two of his own compositions in "Daybreak" and "Melody at Dusk." These tunes are finely rendered by this well-known company of musicians.

Celebrity Records

Maria Nemeth, soprano, with orchestral accompaniment—"In This Castle" ("Turandot") and "Marrietta's Song" ("The Dead City.")

First and foremost, from the point of view of celebrity interest, is the record by Maria Nemeth, who now makes her first appearance on *Decca-Polydor* (*C.A.* 8190). She is a singer with a big world-wide reputation, and is noted most of all for the peculiar clarity of her voice. Some little while ago she had a difference of opinion with Toscanini, the famous Italian conductor, which led to the cancellation of her Vienna concert. I draw particular attention to the two records of six numbers from the "Chout" Ballet of Prokofiev. They are by Albert Wolff, conducting the Lamoureux Orchestra of Paris (*C.A.* 8188-9). It is often said by people who should know that the Lamoureux Orchestra is the best recording symphony orchestra, and I feel that the "Chout" records prove this estimation. Brilliant music, brilliantly played, is brilliantly recorded. The remaining *Decca-Polydor* records of Furtwangler, conducting the Berlin Philharmonic Orchestra, Brailowsky, and Schlusnus complete a real celebrity list for all lovers of the higher types of music.

Decca Records

I am still convinced that the Boswell Sisters and Dorsey Brothers have never done anything better than "Shout, Sister, Shout." Of the two Calloways, I prefer "Moonlight Rhapsody," although Cab Calloway and I have different views as to the type of music such a romantic title should inspire.

The vocal section is no less stimulating—the Mills Brothers in my favourite weakness, "Miss Otis Regrets," and a new number, "My Headache." They introduce a chorus of three muted brass in the last title, which is very intriguing. The Boswells ride that old war horse, "Alexander's Ragtime Band," in harness with "Doggone, I've Done It," which never received the attention it deserved when issued some months ago.

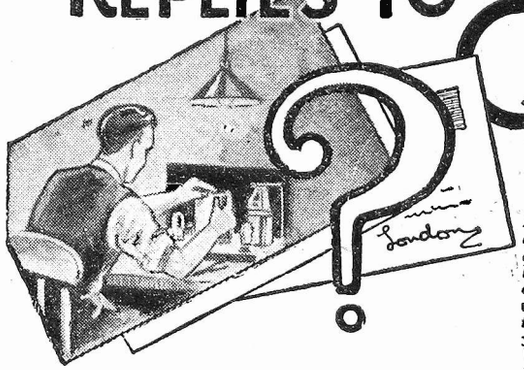
As a climax to this striking collection of records, *Brunswick* is proud to sponsor an album of "hot" records entitled "A Short Survey of Modern Rhythm."

Parlophone Records

Lovers of dancing are well catered for in the recent Parlophone lists by the recording of a number of popular dance tunes, and special mention should be made of "Then I'll be Tired of You" and "Two Cigarettes in the Dark," two foxtrots which are played by the Odeon Dance Orchestra. The feature of this record is that it has been recorded in strict dance tempo and therefore it should make its appeal to many.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff



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

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

SPECIAL NOTE

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

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

Please note also, that all sketches and drawings which are sent to us should bear the name and address of the sender.

Transformer Output

"Can you please tell me if a transformer having secondaries marked as 250+250 v., 60 m.a., 2+2 v., 1 amp., 2+2 v., 5 amp. is the same as one marked 250-0-250 v., 60 m.a., 4 v., 1 amp., and 4 v., 5 amp.?"—D. H. (Derby).

In all probability the two transformers are of exactly the same type, although it is possible that the 4-volt secondaries of the second one are not centre-tapped. The windings are centre-tapped if three terminals are provided for each.

Blueprint Wanted

"Could you please tell me where I could obtain a blueprint for the 1930 battery-operated "Commercial" S.G.-det.-pen. three-valve receiver? I understand that the firm in question has now gone out of business."—W. I. (Blackpool).

So far as we are aware there are no blueprints now available for this receiver since, as you say, the firm is no longer in existence.

Lack of Volume

"I have obtained a second-hand two-valve receiver of well-known commercial make, and although this functions, volume is far from satisfactory. The batteries are all in good condition, and I wonder if you could suggest some simple method of improving the set?"—Y. M. B. (London).

It is difficult to suggest methods of overcoming your difficulty from the brief particulars given. In the first place, however, we would recommend that you try a new set of valves—probably your local dealer would arrange to let you have a set on loan, or to demonstrate the receiver with the new valves in position. Should it be found that the new valves do not give any marked improvement it will be necessary carefully to check all the wiring and to test the individual components.

Three-valve Circuit

"Enclosed please find a circuit of a three-valve receiver that I have recently built; I should be pleased if you would criticise the circuit or make any suggestions for its improvement. I might say that the set has functioned quite well, and I am able to receive fifty stations on the medium-wave band, and seven on long waves."—"Reader" (Castleford).

The circuit which you send is for a perfectly standard type of det.-L.F. receiver using two resistance-coupled L.F. stages. In view of the remarkable results that you have had from the set it would scarcely seem that improvement would be possible, but a slight improvement would probably be obtained by using a good L.F. transformer in place of the first R.C. assembly.

Transformer Ratios

"Could you please tell me the average ratio required for a transformer used to couple together a battery pentode valve and a moving-coil loud-speaker? Also can you please tell me how to find the voltage and current delivered by an electric motor when only the current taken by the field coils and the speed of rotation is known?"—D. O. C. (Tottenham, N.17).

The transformer ratio depends not only upon the optimum load of the output valve, but also on the impedance of the speech coil of the moving-coil speaker. A fairly average ratio for an average battery pentode coupled to a speaker with a 5-ohm speech coil is 35 : 1, but an accurate calculation can only be made by using the following formula:

$$\text{Ratio} = \sqrt{\frac{\text{Optimum load of valve}}{\text{Speech coil impedance}}}$$

In speaking of the output from an electrical machine it would appear that you are confusing a motor with a dynamo, since the motor does not give any current output. Whilst it is possible to make a calculation of the output from a dynamo when all the constructional data is known, we regret that the matter is rather outside the scope of this Free Advice Bureau, and would advise that the best method would be to look up a text book on the subject.

Fitting a Super-power Valve

"I recently fitted a super-power valve in place of the ordinary small-power valve in my three-valve receiver, but all I can receive now is a continuous motor-boating. Can you please tell me where I have gone wrong, and how a cure may be effected? It should be added that the receiver is being operated from an eliminator, the output of which is 40 milliamps, at 150 volts."—R. T. (Tittingbourne).

It would rather appear from the information you give that the new valve is in some way defective, although the trouble may be due to the fact that the eliminator is incapable of supplying the necessary current for this valve. The output should certainly be ample, but if the eliminator is old, and the rectifier somewhat deficient it is possible that the actual output is much less than what it should be. We presume that the G.B. voltage has correctly been adjusted for the new valve, and that the receiver is adequately decoupled: if not, these points should receive attention.

Receiver Design Wanted

"Can you please recommend a blueprint for a receiver to incorporate the following components that I have on hand: .0005-mfd. variable condenser, .0003-mfd. variable condenser, 3-: 1 L.F. transformer, 5 : 1 L.F. transformer, dual-range tuner, three valves, and various other small parts?"—S. S. (Holbeach).

It is very difficult to recommend a blueprint in a case such as yours, since all those issued in connection with receivers described in PRACTICAL WIRELESS, are in connection with definite types of parts. However, it is probable that the parts you have would be suitable for use in the "Sixty-Shilling Three," which was described in PRACTICAL WIRELESS dated December 2nd, 1933. A complete wiring plan was given with this issue, which can be obtained from The Back Number Dept., Geo. Newnes, Ltd., Exeter Street, Strand, London, W.C.2, at 5d. post paid.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face type and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. Radio components advertised at below list price do not carry manufacturers' guarantee. All communications should be addressed to the Advertisement Manager, "Practical Wireless," 8, Southampton Street, Strand, London.

PREMIER SUPPLY STORES

ANNOUNCE a City Branch at 165 and 165a, Fleet St., E.C. (next door to Anderton's Hotel) for the convenience of callers; post orders and callers to High St., Clapham.

OFFER the Following Manufacturers' Surplus New Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra, I.F.S. and abroad, carriage extra. Orders under 5/- cannot be sent c.o.d. Please send for Illustrated catalogue, post free.

ALL-ELECTRIC 3-stage Amplifiers, 200-250v., 40-60 cycles, 10 watts undistorted output, complete with 5 valves, and Magnavox Super 66 energised speaker, £12/10/0.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, condensers, resistances, and diagram, 120v. 20 m.a., 20/-; trickle charger, 8/- extra; 150v. 30 milliamps with 4v. 2-4 amps, C.T., L.T., 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps, with 4v. 3-5 amps. C.T., L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps., 37/6; 200v. 50 m.a., with 4v. 3-5 amps., L.T., 27/6.

PREMIER Chokes. 40 milliamps, 25 hys., 4/-; 65 milliamps, 30 hys., 5/6; 150 milliamps, 30 hys., 10/6; 60 milliamps, 80 hys., 2,500 ohms, 5/6; 25 milliamps., 20 hys., 2/9; 250 milliamps, 30 hys., 20/-.

PREMIER Auto Transformers, 100-110/200-250v. or vice versa, 100-watt, 10/-.

WESTERN ELECTRIC Mains Transformers, 300-0-300v. 65 m.a., 4v. 1-2a., 4v. 2-3a., 6/6; 500-0-500v. 150 m.a., 4v. 3-5a., 4v. 2-3a. 4v. 2-3a., 4v. 1a. C.T., 4v. 1a. C.T., 19/6.

SPECIAL Offer of mains Transformers, manufactured by Phillips, input 100-110v. or 200-250v., output 180-0-180 volts 40 m.a., 4v. 1 amp., 4v. 3 amps., 4/6.

PREMIER L.T. Charger Kits, consisting of Premier transformer and Westinghouse rectifier, input 200-250v. A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v., 2 amp., 27/6; 30v. 1 amp., 37/6; 2v. ½ amp., 11/-.

B.T.H. Truspeed Induction Type (A.C. Only), Electric Gramophone Motors, 100-250v., 30/- complete. D.C. model Truspeed, 100/250v., 47/6.

COLLARO Gramo. Unit, consisting of A.C. motor, 200-250v. high quality pick-up and volume control, 49/-.

EDISON BELL Double Spring Gramophone Motors, complete with turntable and all fittings, a really sound job, 15/-.

SPECIAL Offer of Wire-Wound Resistances, 4 watts; any value up to 50,000 ohms, 1/-; 8 watts any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

CENTRALAB Potentiometers, 400 ohms, 1/-; 50,000, 100,000, ½ meg., any value, 2/-; 200 ohms, wire wound, 1/-.

SPECIAL OFFER. Kolster-Brandes (shop-soiled) 2-valve Battery Pup, with self-contained Speaker, Valves and Batteries, 27/6.

AMERICAN Triple gang 0.0005 Condensers, with Trimmers, 4/11; Utility bakelite 2-gang 0.0005, screened, with Uniknob trimmer, and complete slow-motion dial, 3/6; Polar bakelite condensers, 0.00035, 0.0003, 0.0005, 1/-.

RELIABLE Intervalve Transformers, 2/-; multi-ratio output transformers, 2/6; Microphone transformers, 50-1 and 100-1, 2/6; 1-1 or 2-1 Output Transformers, 2/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 144, 2,500 ohms, 12/6; D.C. 152 magna., 2,500 ohms, 37/6, all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M. 7in. cone, 16/6; 9in. cone, 22/6.

RELIABLE Canned Coils with Circuit accurately matched, dual range, iron cored, 2/11.

POLAR Star manufacturers' model, 3-gang condensers, fully screened, 7/6, with trimmers; unscreened, 5/-.

UTILITY 3-gang Condensers. 0.0005, fully screened, with trimmers, ball bearing straight- or superhet, 6/9, complete; with illuminated disc drive, 7/11, the best 3-gang available.

T.C.C. Condensers, 250v. working, 1 mf., 1/3; 2 mf., 1/9; 4 mf., 3/-; 4 mf. 450v. working, 4/-; 4 mf., 750v. working, 6/-; 2 mf., 750v. working, 3/-.

VARLEY Constant Square Peak Coils, bandpass type B.P.7 brand new, in maker's cartons, with instructions and diagram, 2/4.

VARLEY H.F. Intervalve Coils, B.P.S., band-pass, complete with instructions, in original cartons, 2/6.

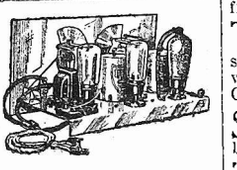
SCREENED H.F. Chokes, by one of the largest manufacturers in the country, 1/6.

(Continued at top of column three)

Easy Terms

ALL MANUFACTURERS' COMPONENTS and ACCESSORIES in STOCK. SEND US YOUR ENQUIRIES

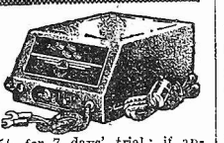
LISSEN SKYSCRAPER THREE KIT



Chassis Model with (Lissen) S.G. Detector and Pentode Valves. Send only 5/-, balance in 11 monthly payments of 5/6. Cash or C.O.D. Carriage Paid, £3/0/0.

5/- DOWN

ATLAS ELIMINATOR



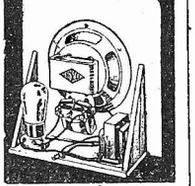
SENT ON 7 DAYS' TRIAL.

Model T10/30. For Class B and Q.P.P. A.C. 200/250 volts 40/120 cycles. Three tappings: 10, 20, or 30 ma. at 120/150 volts. Trickle charger incorporated 2 volts .5 amp. Send only 5/- for 7 days' trial; if approved, balance in 12 monthly payments of 6/-. Cash or C.O.D. Carriage Paid, £3/9/6. **Atlas Model C.A.25.** Cash or C.O.D. Carriage Paid, £2/19/6, or 5/- Deposit and 11 monthly payments of 5/6.

5/- DOWN

N.T.S. CLASS 'B' SPEAKER-AMPLIFIER

"JUST PLUGS-IN." GIVES SEVEN TIMES THE VOLUME, READY ASSEMBLED WITH CLASS B VALVE.



Send only 5/- and instantly convert your present set to Class B output. Balance in 9 monthly payments of 5/-. Cash or C.O.D. Carriage Paid, £2/5/0.

5/- DOWN

B T-H NEEDLE ARMATURE PICK-UP, TONE-ARM and VOLUME CONTROL

Complete with Pick-up rest, flexible lead, 100,000 ohm Volume Control, instructions and template for fixing both Tone Arm and Volume Control. Send only 2/6, balance in 10 monthly payments of 4/3. Cash or C.O.D. Carriage Paid, £2/0/0.

2/6 DOWN

3-VALVE STRAIGHT BATTERY RECEIVER

Complete with Cabinet and Cone Speaker, less Valves and Batteries.

3-Valve Screened Grid Receiver. Cash or C.O.D. 32/6. *Carriage and Packing 2/6 extra.*

3-Valve Class "B" Receiver with M.C. Speaker. Cash or C.O.D. 39/6. *Carriage and Packing 2/6 extra.*

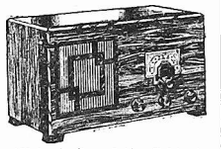
Cash or C.O.D.

27/6

Carriage and Packing 2/6 extra.

Send for lists of many more similarly attractive bargains.

PILOT AUTHOR KIT HALL-MARK 3



Complete Kit of parts for building, including pair B.T.S. Hall Mark 3 Coils, less valves, cabinet and speaker. Send only 5/-; balance in 11 monthly payments of 4/-. Cash or C.O.D. Carriage Paid £2/5/0. Or complete with valves and Peto-Scott Walnut Consolette Cabinet (illustrated). Cash or C.O.D. Carriage Paid £4/0/9, or 7/6 deposit and 11 monthly payments of 7/3.

5/- DOWN

SEND FOR LATEST LISTS

New Times Sales Co

56, LUDGATE HILL, LONDON, E.C.4.

(Continued from foot of column one)

PREMIER British-made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50 m.a., 0-100, 0-250 m.a., 0-1; 0-5 amps.; all at 6/-.

WESTERN Electric Condensers, 250v. working, 1 mf., 6d.; 2 mf., 1/-; 4 mf., 2/-; 400v. working, 1 mf., 1/-; 2 mf., 1/6; 4 mf., 3/-.

WIRE-WOUND Potentiometers, 1,000, 2,500, 10,000, 50,000, 500,000, 2/- each; 1,000 ohm, semi-variable, carry 150 ma., 2/-.

A LARGE Selection of Pedestal, table and radio-gram cabinets, by best manufacturers at a fraction of original cost. Send for list.

THE following Lines 6d. each, or 5/- per dozen.—Chassis valve holders 5-, 6-, or 7-pin, screened screen-grid leads, any value 1-watt wire resistances, wire end condensers 0.0001 to 0.1, 3 amp. main switches, Cyldon capacitors; double trimmers.

SUPER-MOVING Coil Speakers, handle 10 watts, energised directly from A.C. mains, manufactured by world-famous radio and gramophone company, 40/-.

T.C.C. Electrolytic condensers, 8 mf. 440v. working, 3/-; 4 mf. 440v. working, 3/-; 15 mf. 50v. working, 1/-; 50 mf. 12v. working 1/-; 15 mf. 100v. working, 1/3; 6 mf. 50v. working, 6d.; 2 mf. 100v. working, 6d.

DUBILIER Dry Electrolytic Condensers, 12 mf. 20v. working, 6d.; 50 mf. 50v. working, 1/9.

CONDENSER Blocks, H.M.V. 400v. working, 4+2+1+1+1+.5 3/9; 2+2+1+1+1+.5, 3/-; Dubilier 300v. working, 4+4+2+.1, 3/-; Phillips 6+4+2+1+1, 4/6.

PREMIER SUPPLY STORES Announce the Purchase of the Complete Stock of a World Famous Continental valve manufacturer, all the following standard main types, fully guaranteed, 4/6 each; H.F. Pentodes, Variable-Mu H.F. Pentodes, H.L., L. power, medium, high, low mag. and variable-mu screen-grids, one, three and four watt A.C. output, directly heated pentodes, 250v. 60 ma., full wave rectifiers D.C. types, 20v. 1S amp., filaments, screen grid V.M., H., H.L. Power, Pentodes, H.F. Pentodes, Variable-Mu H.F. Pentodes.

THE Following Types, 5/6 each; 350v. 120 ma., full wave rectifier, 500v. 120 m.a., full wave rectifier, 2½ watt indirectly heated pentode.

THE Following American Types, 4/6; 250, 112, 171, 210, 245, 226, 47, 46, 24, 35, 51, 57, 58, 55, 37, 80, 6A7, 2A7, 83, 27.

THE Following Types, 6/6 each; 42, 77, 78, 25Z5, 36, 38, 83, 39, 44, 53, 6B7, 2A5, 2A6, 267, 5Z3, 6C6, 6A4, 6D6, 6F7, 43, 59. Send for Complete Valve list.

GRAMPIAN Permanent Magnet 9 inch Moving Coil Speakers, handles 4 watts, Universal Transformers, 18/6. Ditto Energised handles 5 watts, 2,500 ohms, 21/-.

SCOTT Aerial and Anode Coils. Dual Range with Circuit, 2/6 per pair.

ELLIOTT Moving-Coil Milliameters projecting type, 2½in. diameter, 0-10, 0-30, 0-50, 0-150, 15/-.

DARIO directly-heated 1 watt, 200v. Mains Power Valves, 2/6.

BLUE SPOT 45 P.M. Speaker, multi-ratio transformer, handles 4 watts, listed 45/-, at 25/-, or in handsome walnut cabinet, 35/-. Blue Spot 99 P.M. Speaker, multi-ratio transformer, handles 5 watts, listed 59/6, at 31/-.

BLUE SPOT Energised Speakers, 2,500 ohms type 29D.C., Power and Pentode Transformer, 9/11.

SUPER Moving-Coil Speaker by world-famous radio and gramophone company, 300v. 30 m.a. field (10,000 ohms), 25/-. Handles 10 Watts.

MAGNAVOX Super 66 Multi-Ratio Transformer, 2,000 ohm field, £4/4/0, with metal rectifier energiser for 200/250 A.C., £5.

PREMIER SUPPLY STORES

(Dept. G.N.), 20-22, High St., Clapham, S.W.4. 'Phone: Macaulay 2188. Nearest station: Clapham North. Underground.

HULBERT, 6, CONDUIT STREET, W.1.

Read below:

If you are requiring realistic reproduction at remarkable low cost, send for one of the following high-grade speakers. Repeat orders are coming in daily.

10/6 only. Brand-new manufacturer's surplus moving-coil speakers, made by one of the best-known British makers. Energised, 2,000, 2,500, or 6,500 ohms field windings, power or pentode transformer, 8in. cone, 10/6 each.

12/6 only. As above, but with 10in. cone. A very powerful speaker capable of handling large outputs.

15/6 only. Brand-new manufacturers' surplus moving-coil speakers, made by one of the best-known British makers. Permanent-magnet model of high efficiency with power or pentode transformer, 8in. cone, 15/6 each.

17/6 only. As above, but with 10in. cone. Ideal for use with quality receivers such as the £5 3-valve Super Het.

2/9 only. Brand-new cabinets suitable for above speakers, 2/9 each only. Secure one of these amazing speaker bargains now. Repeat orders are coming in daily. Cash with order or C.O.D.

HULBERT, 6, CONDUIT STREET, W.1.

RADIO CLEARANCE, 280, HIGH HOLBORN, W.C.1, offers the following stupendous bargains limited quantities only. To orders over 5/- post free. 'Phone: Holborn 4631.

7 VALVE Superhet Plessy Chassis made for proprietary firm whose name we are not allowed to mention; 7 tuned stages; delayed A.V.C.; local distance switch; 7 kc/s separation; Mullard valves; A.C. 200-250 volts. Demonstrations daily. Chassis complete with valves, brand new, less speaker and cabinet, £7/10/0.

RADIO CLEARANCE offers Dorchester 3 Valve Screen Grid Detector, Power, or Pentode Battery Chassis, including all first-class Components, brand new, completely wired, at 35/-, less Valves.

RADIO CLEARANCE makes special offer of a limited quantity S.T. 600 Dorchester Kits to designer's specification, including Colvern Coils, Polar Condensers, T.C.C. Fixed Condensers. R.I. Hypermite Transformer, Metallised Baseboard, Ready drilled Panel and Terminal Strip, list price, £5/17/0; our price, £3/10/0.

RADIO CLEARANCE offers 1 Watt Resistances, well-known make, all sizes, 6d. each.

RADIO CLEARANCE offers Wego 2 mfd. Condensers, canned type, 1s. each.

RADIO CLEARANCE offers 8 mfd. Dry Electrolytic 500 volt working, well-known make, 2/6 each.

RADIO CLEARANCE offers White Sleeving, 1½ m.m., 9d. doz. lengths.

RADIO CLEARANCE offers Telsen 0001-00015 Reaction Condensers and 0003 Tuning Condensers 7d. each.

RADIO CLEARANCE offers British Radiophone 3-gang Condensers with 3 .0005 sections, complete with Dial, Escutcheon, and Pilot Holder, 7/6 each.

RADIO CLEARANCE offers 1/25 H.P. Motors (Gilbert) 100-115 volts A.C. for Television, suitable for 200-250 Volts for use with 700 Ohm Resistances or 30 Watt Lamps, price 10/6.

RADIO CLEARANCE offers Variable Power Resistances by well-known maker, 0-100 Ohms; price 3/- each, exceptional value.

RADIO CLEARANCE offers British Radiophone Triple Gang Condensers, 2XO .0005 and 110 kc/s oscillator section complete with knob, drive, escutcheon; 7/6 post free.

RADIO CLEARANCE offers British Radiophone 110 kc/s Intermediate Frequency Transformers, 3/-.

RADIO CLEARANCE offers 8,000 Ohm Volume Controls. Log. type, with Q.M.B. switch, by G.E.C., 2/6.

RADIO CLEARANCE offers Set of Band-Pass Coils, manufacturer's type, with circuit diagram suitable for tuned grid or tuned anode; set of 3 coils, 4/6.

RADIO CLEARANCE offers Mains Transformers, unshrouded, manufacturer's type, primary 200-250, secondary 320-0-320v. at 70 m.a., 2-0-2v. at 3 amps. 6/6 post free.

RADIO CLEARANCE offers L.F. Transformers, 3 : 1 and 5 : 1, manufacturer's type, 1/6 each.

RADIO CLEARANCE offers L.F. Transformers, shrouded, 3 : 1 and 5 : 1, price 1/9 each.

RADIO CLEARANCE offers Steel Chassis, cadmium plated, drilled ready for use, 3 Valve, 1/-; 4 Valve type, 1/6.

RADIO CLEARANCE offers Metal Chassis, 2-, 3- and fitted with Valve Holders and Terminal Strip, 2/-.

RADIO CLEARANCE offers "Centralab" Potentiometers, 50,000 ohms, price 1/6 each.

RADIO CLEARANCE offers T.C.C. Condensers, 0.5 mfd. 800 volt D.C. working, 1/- each; T.C.C. Condensers, 1 mfd. 250 volt D.C. working, 1/- each; T.C.C. Condensers, 1 mfd. 800 volt D.C. working, 1/6 each; T.C.C. Condensers, 2 mfd. 405 volt working, 1/6 each; T.C.C. Condensers, 6 mfd. 250 volt D.C. working, 2/- each; T.C.C. Condensers, 6 mfd., 350 volt D.C. working, 2/6 each: T.C.C. Condensers, 4 mfd. block, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, and 1 mfd. 250 volt A.C. working, 2/6 each.

RADIO CLEARANCE offers British Radiophone 3 gang Midget type condensers 3 .0005 sections fully screened with trimmers 7/6 each.

RADIO CLEARANCE offers British Radiophone 3 gang Midget type Superhet condensers 2 .0005 sections and 1 110 k/cs section fully screened with trimmers 7/6 each.

RADIO CLEARANCE, 280, High Holborn, W.C.1. 'Phone: Holborn 4631.

RADIALADDIN (Disposals), Ltd. Exchange your old set for any new model, balance cash or H.P. Write for free quotation to largest radio exchange in U.K. Also clearance sale of reconditioned sets and radiograms at gift prices £1 to £10. Write for list.—46, Brewer Street, Piccadilly Circus, W.1. Gerrard 4055.

WANTED, good modern wireless parts, sets, eliminators, meters, valves, speakers, etc. Spot cash waiting. Exchanges. Send or bring. We pay more than any other dealer. Open 9-8.—University Radio, 142, Drummond St., Euston, N.W.1. Phone: Museum 3810.

There was a young fellow named Jim
Complained that his Set had gone "dim";
He found on inspection—
An "unsoldered" connection—
So FLUXITE put THAT right for HIM!

See that FLUXITE is always by you—in the house—garage—workshop—anywhere where simple speedy soldering is needed. Used for 30 years in Government works and by the leading Engineers and Manufacturers. OF ALL IRONMONGERS—IN TINS 4d., 8d., 1/4d., and 2/8d.

Ask to see the FLUXITE SMALL-SPACE SOLDERING SET—compact but substantial—complete with full instructions—7/6. Ask also for Leaflet on CASE-HARDENING STEEL and TEMPERING TOOLS with Fluxite.

THE FLUXITE GUN

(Registered)

is a handy and economical tool that enables you to put the Fluxite where you want it on the soldering job and is clean and simple to use. Nothing to remove—no mess—no trouble. Always READY FOR USE.

Also used to project grease into grease cups, bearings, etc. Just fill the nozzle portion—half fill the cup—put together and press, as required. Price 1/6d.

ALL MECHANICS *WILL* HAVE

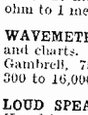
FLUXITE

IT SIMPLIFIES *ALL* SOLDERING

FLUXITE LTD. (Dept. W.P.), DRAGON WORKS, BERMONDSEY STREET, S.E.1.

ELECTRADIX

TELEPHONES—The cheapest tester is a pair of 2/9 Sullivan, phones and a 6d. cell for any circuit, Brown's "A" reed for short-wave sets, 1,500 ohms, 21/6, 120 ohms 17/6, Western Elec. 2,000 ohms, 4/3 pair.



MEGGERS AND OHMMETERS. Evershed Bridge with decade res. box, 10,000 ohms. Several Meggers, 100 volts, 250 volts and 500 volts, and small MEG. for D.C. mains. N.C.S. Ohmer, 500 volts to 20 megs. Ev. Edg. Metrohm, 250 volts .01 to 20 megs. Silvertown Portable Test Set, Bridge type, .001 ohm to 1 meg.

WAVEMETERS. McLachlan, S.G. Valve, 20 to 5,000 metres and charts. Gambrell, type D, 220 to 500 metres. Long Range Gambrell, 75 to 12,000 metres. Sullivan Het. in metal case, 300 to 16,000.

LOUD SPEAKERS. Two Siemens' Giant 'Riffels, 26in. × 11in. Heard two miles away, 40/- each.

DIX-MIPANTA VEST POCKET TESTER. A wonderfully versatile moving-iron multirange meter for service on A.C. or D.C. jobs. No projecting terminals. THREE ranges of volts.: 0-7.5, 0-150, 0-300. Used for MILLIAMPS., reads: 0-12½ m/A, and 0.75 m/A. In black bakelite case. Measures only 2½in. by 2½in., with pair of test leads & plugs. Leaflet "N" gives full information. **19/6**

WRITE FOR LATEST RADIO BARGAIN LIST "N"

We are able to offer from stock STAMPINGS FOR CHOKES AND TRANSFORMERS of 15 sizes and shapes at 50% off list prices. Samples of any pair of stampings sent on receipt of envelope with 1½d. stamp.

PARCELS of useful oddments for the Experimenter who wants a junk-box of Coils, Magnets, Wire, Chokes, Condensers, Switches, etc., mostly ex W.D., parts worth a lot more than 10 lbs. 7/-, or 7 lbs. for 5/-, post free. British Isles only.

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218, UPPER THAMES STREET, E.C.4

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PRACTICAL TELEVISION

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RECEIVERS.—G. E. C. Osram Four-valve (Actual) sets. With four Osram valves, permanent magnet moving-coil speaker. Magnificent pedestal cabinet. Ready to use on all voltages. A.C. all Osram proprietary components in original cartons, £6/15/- (list £15/15/-).

CROMWELL 3-valve Battery Sets, with three Cossor valves, Permanent magnet moving-coil speaker in magnificent walnut cabinet. New, in sealed cartons. £3/12/6 (list £8).

BURGOYNE CLASS "B" RECEIVERS 1935 Series. New in sealed cartons, with three Mullard valves. Exide Batteries and Accumulator. P.M. Moving Coil Speaker. Attractive cabinet magnificently finished with chromium fittings, £3/19/6 (list £6/10/-).

TELSEN 3-valve Battery Sets. In attractive Bakelite Cabinet. Complete with 3 Mazda valves. New, in sealed cartons, 33/- each (list £3/15/-).

COILS.—Igranic Superhet Set of Four (1 osc., 2 I.F. with Pigtails, 1 L.F. Plain), 12/6 (list 50/-). Lissen Superhet three coil Kit. Screened Ganged on Base with switch. Type L.N. 5181, 9/6.

VARLEY Constant Square Peak Coils B.P. 5, with all accessories in cartons, 2/3.

LEWCOS T.B.F./C, O.S.C./126 (Extensor), T.O.S./R, all at 3/6 each.

PICK-UPS.—Marconi Model K. 25 (1935 issue), 21/- (list 32/6).

CONDENSERS.—Lotus, 3-gang, 12/6; 2-gang, 8/6; All capacity 0.0005. Fully screened with trimmers, with dials, knobs and escutcheons. Plessy four-gang condensers, superhet type. Fully screened with trimmers (less dials), any standard dial will fit, 7/3 each (list 45/-).

DUBILIER Block Condensers, 4mfd. (2 x 1 x 1) 1,000-volt, 2/9; 4.5 mfd. (2.25 x 2.25), 3/-; T.C.C. (0.1 + 0.1), 1/3 each.

SPEAKERS.—Blue Spot 66R Units, brand new and boxed, 10/6 (list 35/-), complete mounted on Blue Spot Chassis, 16/6 (list 45/-). Blue Spot Permanent Magnet Moving Coil Speakers, universal Transformer for Class "B," Super-Power, Power, or Pentode, ALL BRAND NEW 1935 Series in sealed cartons. Type 45 P.M., 26/- (list 45/-); 99 P.M., 30/- (list 59/6); 62 P.M., in magnificent cabinet, 38/- (list 67/6); 32 P.M. in exquisitely finished cabinet, 45/- (list 87/6). All Brand New.

MISCELLANEOUS.—Westinghouse Metal Rectifiers, H.T. 6, 7, 8, 9/3. Morse Tapping Keys, with flash signal and buzzer, complete with battery and bulb, 2/-. Bifo Static Cut-Outs definitely clears interference and all unwanted noise without affecting volume, 2/3 each (list 12/6).

THOUSANDS of other bargains. Callers are assured of a tremendous saving in all branches of wireless needs by visiting any of our shops.

ALL goods guaranteed and sent post paid.

BRANCHES at 46, Lisle Street, W.C.2; 271/275, High Road, Willesden Green, N.W.10. All Mail Orders to 323, Euston Road, N.W.1.

SOUTHERN RADIO, 323, Euston Road, London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324.

THE following unused set manufacturers' Surplus; all goods guaranteed perfect; immediate delivery. MAGNAVOX speakers, complete with hum-bucking coil, output transformers, etc. DC152 (9in. cone), 22/6. DC154 (7in. cone), 16/-. All with 2,500 or 6,500 ohms fields.

WESTINGHOUSE rectifiers, HT8, 9/6. HT9, 10/-, HT10, LT5, LT4, 10/9. Regentone transformers for HT8 or HT9 with 4v. 4amp. LT winding, 7/-. Eliminators, first-class make. Outputs 150v, 25ma, SG and detector. AC type with Westinghouse rectifier, 25/-. AC type with .5 amp. trickle-charger, 30/-. DC type, 12/6.

DUBILIER or TCC dry electrolytic condensers 8mfds or 4mfds, 500v working, 50mfds, 50v, 200mfds, 10v, 3/3. 50mfds, 15v. and 15mfds, 100v, 2/3. 50mfds, 12v, 2/-. TCC type "M" condensers, any value up to .001mfds, 6d. Eric resistances. 1 watt type, 7d., 2 watt, 1/2, 3 watt, 1/9. Send for comprehensive list.

WARD, 45, Farringdon Street, London, E.C.4. Telephone: Holborn 9703.

ALL REPAIRS to Moving Coil Speakers, prices quoted. Loud-speakers, L.F. and Speech Transformers, 4/- each. Post free. Satisfaction guaranteed. Prompt service.—L.S. Repair Service, 5, Balham Grove, London, Battersea 1321.

MAINS Transformers, chokes, etc., to specification, repairs promptly executed. Guaranteed satisfaction. Prices on request. Henry Peace, Ltd., Wednesbury, Staffs.

EXPERIMENTER'S EXTRAORDINARY OPPORTUNITY. Parcels containing 40/- value Wireless Components 5/6, carriage 1/-.

EXPERIMENTER'S EXTRAORDINARY OPPORTUNITY. Bargain Bulletin supplied Free—10/- Gift Voucher presented first Twenty applicants daily.—Taylor's Radio House, Macaulay Street, Huddersfield.

HALLMARK THREE, Superhet Three, ST600 Guaranteed First Specified Kits—Lowest Prices—Easiest Terms—Lists Free.—Melfo-rad, Queen's Place, Hove. (Trade Supplied.)

FREE ADVICE BUREAU

COUPON

This coupon is available until January 26th, 1935, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 19/1/35.

ADVERTISEMENT INDEX

RADIO CLEARANCE, 280, HIGH HOLBORN, W.C.1, offers the following stupendous bargains limited quantities only. To orders over 5/- post free. 'Phone: Holborn 4631.

7 VALVE Superhet Plessy Chassis made for proprietary firm whose name we are not allowed to mention; 7 tuned stages; delayed A.V.C.; local distance switch; 7 kc/s separation; Mullard valves; A.C. 200-250 volts. Demonstrations daily. Chassis complete with valves, brand new, less speaker and cabinet, £7/10/0.

RADIO CLEARANCE offers Dorchester 3 Valve Screen Grid Detector, Power, or Pentode Battery Chassis, including all first-class Components, brand new, completely wired, at 35/-, less Valves.

RADIO CLEARANCE makes special offer of a limited quantity S.T. 600 Dorchester Kits to designer's specification, including Colvern Coils, Polar Condensers, T.C.C. Fixed Condensers. R.I. Hypermite Transformer, Metallised Baseboard, Ready drilled Panel and Terminal Strip, list price, £5/17/0; our price, £3/10/0.

RADIO CLEARANCE offers 1 Watt Resistances, well-known make, all sizes, 6d. each.

RADIO CLEARANCE offers Wego 2 mfd. Condensers, canned type, 1s. each.

RADIO CLEARANCE offers 8 mfd. Dry Electrolytic 500 volt working, well-known make, 2/6 each.

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RADIO CLEARANCE offers British Radiophone 3-gang Condensers with 3 .0005 sections, complete with Dial, Escutcheon, and Pilot Holder, 7/6 each.

RADIO CLEARANCE offers 1/25 H.P. Motors (Gilbert) 100-115 volts A.C. for Television, suitable for 200-250 Volts for use with 700 Ohm Resistances or 30 Watt Lamps, price 10/6.

RADIO CLEARANCE offers Variable Power Resistances by well-known maker, 0-100 Ohms; price 3/- each, exceptional value.

RADIO CLEARANCE offers British Radiophone Triple Gang Condensers, 2XO .0005 and 110 kc/s oscillator section complete with knob, drive, escutcheon; 7/6 post free.

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RADIO CLEARANCE offers 8,000 Ohm Volume Controls. Log. type, with Q.M.B. switch, by G.E.C., 2/6.

RADIO CLEARANCE offers Set of Band-Pass Coils, manufacturer's type, with circuit diagram suitable for tuned grid or tuned anode; set of 3 coils, 4/6.

RADIO CLEARANCE offers Mains Transformers, unshrouded, manufacturer's type, primary 200-250, secondary 320-0-320v. at 70 m.a., 2-0-2v. at 3 amps. 6/6 post free.

RADIO CLEARANCE offers L.F. Transformers, 3 : 1 and 5 : 1, manufacturer's type, 1/6 each.

RADIO CLEARANCE offers L.F. Transformers, shrouded, 3 : 1 and 5 : 1, price 1/9 each.

RADIO CLEARANCE offers Steel Chassis, cadmium plated, drilled ready for use, 3 Valve, 1/-; 4 Valve type, 1/6.

RADIO CLEARANCE offers Metal Chassis, 2-, 3- and fitted with Valve Holders and Terminal Strip, 2/-.

RADIO CLEARANCE offers "Centralab" Potentiometers, 50,000 ohms, price 1/6 each.

RADIO CLEARANCE offers T.C.C. Condensers, 0.5 mfd. 800 volt D.C. working, 1/- each; T.C.C. Condensers, 1 mfd. 250 volt D.C. working, 1/- each; T.C.C. Condensers, 1 mfd. 800 volt D.C. working, 1/6 each; T.C.C. Condensers, 2 mfd. 405 volt working, 1/6 each; T.C.C. Condensers, 6 mfd. 250 volt D.C. working, 2/- each; T.C.C. Condensers, 6 mfd., 350 volt D.C. working, 2/6 each: T.C.C. Condensers, 4 mfd.. block, 0.5, 0.5, 0.5, 0.5, 0.5, and 1 mfd. 250 volt A.C. working, 2/6 each.

RADIO CLEARANCE offers British Radiophone 3 gang Midget type condensers 3 .0005 sections fully screened with trimmers 7/6 each.

RADIO CLEARANCE offers British Radiophone 3 gang Midget type Superhet condensers 2 .0005 sections and 1 110 k/cs section fully screened with trimmers 7/6 each.

RADIO CLEARANCE, 280, High Holborn, W.C.1. 'Phone: Holborn 4631.

RADIALADDIN (Disposals), Ltd. Exchange your old set for any new model, balance cash or H.P. Write for free quotation to largest radio exchange in U.K. Also clearance sale of reconditioned sets and radiograms at gift prices £1 to £10. Write for list.—46, Brewer Street, Piccadilly Circus, W.1. Gerrard 4055.

WANTED, good modern wireless parts, sets, eliminators, meters, valves, speakers, etc. Spot cash waiting. Exchanges. Send or bring. We pay more than any other dealer. Open 9-8.—University Radio, 142, Drummond St., Euston, N.W.1. Phone: Museum 3810.

There was a young fellow named Jim
Complained that his Set had gone "dim";
He found on inspection—
An "unsoldered" connection—
So FLUXITE put THAT right for HIM!

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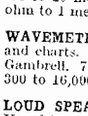

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RADIO CLEARANCE offers British Radiophone 3 gang Midget type Superhet condensers 2 .0005 sections and 1 110 k/cs section fully screened with trimmers 7/6 each.

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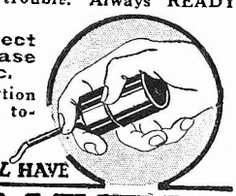

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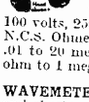

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