THE LATEST TELEVISION NEWS

—SEE PAGE 336

Practical and Amateur Wireless

AND PRACTICAL TELEVISION

3d EVERY WEDNESDAY

Edited by F. J. CAMM

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Vol. 8. No. 195. June 13th, 1936.

All about MICROPHONES

A GENERAL-PURPOSE H.F. UNIT

See page 344

ROUND *the* WORLD *of* WIRELESS

Another French Station Moves

RADIO Sud-Ouest, a privately owned 2.5-kilowatt broadcasting transmitter at Bordeaux (France), which has been working on 309.9 m. (968 kc/s) is being transferred to a site some few miles from the city. The power is to be generously increased, but the wavelength may be retained.

Relay of Berlin Olympic Games

SOME 350 special cables have been laid in and around the Stadium and other sports arenas in which International competitions are to take place. Fifteen microphones have been installed near the swimming pool, ten on the Grand Stand, fourteen in the general sports' arena, and thirty on the motor tracks. The main transmitter will be capable of carrying out thirty separate broadcasts simultaneously, and it is expected that these will be taken by roughly three hundred and twenty German and foreign broadcasting stations.

Paris P.T.T. on High Power

LISTENERS, without doubt, will have noticed the recent increase in the strength of signals emanating from Paris P.T.T. The 120-kilowatt transmitter at Villebon-sur-Yvette is now working daily, and the old *Ecole Superieure* station is being kept solely as a stand-by in the event of a breakdown.

Two Strings to Its Bow

THE 20-kilowatt Bolzano (Italy) station, which was formally opened on May 10th, is connected not only by cable but also possesses a microwave transmitter to ensure a good relay in the event of interference, or other "technical hitch," causing a breakdown in the link with its studios in the city.

The English Language Leads

IN the course of a century the number of people speaking the English language has jumped from 20 to 220 millions; Russian from 33 to 170 millions; the German increase has been from 42 to 90 millions, and the Italian from 21 has attained 45 millions. France, of all European countries, is at the bottom of the list; in 100 years she has only progressed by 13 millions over the original 32 millions computed at that time. There seems to be little doubt that the English language is now the one which is most heard in the ether.

Popularising Radio in Poland

IN order to induce listeners to continue to use their wireless sets during the summer months the Polish broadcasting organisation has offered a series of prizes, including a motor car and a trip to the United States, for the solution of a simple competition.

Proposed Broadcasting Station in Irak

IT is reported that the 20-kilowatt broadcasting station which it is proposed to erect in the neighbourhood of Baghdad, and which it is hoped to complete in 1937, will operate on 391.1 m. (767 kc/s), the channel now used by Scottish Regional.

An Interesting Relay

THE 24 Hours Le Mans Automobile Circuit will be broadcast on June 13th—14th by Radio-Normandie (Fécamp) on 269.5 m. (1,113 kc/s). In view of the interest taken in this event in Great Britain the running commentary will be given in both French and English.

Alterations in Wavelength

IN order to put an end to the interference existing between Spanish stations, Valencia (EAJ3) in future will broadcast on 238.5 m. (1,258 kc/s) and Seville (EAJ5) on 352.9 m. (850 kc/s). It should now be possible to pick up the individual transmissions.

More Mexican Stations

TOWARDS the end of 1936 Mexico will start the construction of twelve new transmitters of which one with a power of 150 kilowatts is to be built at Villa Achuna (Coahuila). For the transmission of programmes to neighbouring States it is proposed to add three short-wave stations to the Mexican network.

Holland Also Wants to Televise

THE Dutch authorities have instituted a commission for the study of the various television systems. The main difficulty with which the State has to contend is the fact that transmitting licences for broadcasts have been granted to several organisations, and the establishment of a television service would necessitate close co-operation.

New Relay Station for Germany

ANOTHER 5-kilowatt broadcasting station is shortly to be added to the Hamburg network; it will be installed at Stolp (Pomerania), some seventy miles to the north-north-west of Danzig. The channel to be used is one common to other Hamburg relays, namely, 225.6 m. (1,330 kc/s).

A Characteristic Interval Signal

AS a musical interval signal the Torun (Poland) station, working on 304.3 m. (986 kc/s), has adopted the first few chords of a popular folk-song, long used by timber drifters on the Vistula. It was made famous by being incorporated in an operatic score written by the Polish composer, Moniusko.

"Weather, London"

THIS is the call of the Air Ministry station at Borough Hill (Northants), from which you may hear frequently every day weather reports and forecasts destined to the aviation services. The wavelength is now 1,181 m. (254 kc/s).

THE PICK of the PROGRAMMES

Midland Composers' Concert

H. FOSTER CLARK will conduct the B.B.C. Midland Orchestra in this concert, which will be given on June 20th. Thelma Reiss is to be the 'cellist for the Elgar concerto in E minor. The programme will open with a divertimento by a Worcester composer, Brent Smith, and will close with the Overture to "The Wasps," by Dr. Vaughan Williams, who was born in Gloucestershire.

MAKE THESE DATES WITH YOUR RADIO

Hour and in the musical comedy, "Mariella." He is a Warwickshire artist.

Concert from the Western Studio

DOROTHY ALSOP (mezzo-soprano), Herbert Charles Powell (baritone), and Arthur C. Waters (pianoforte) will be

A BROADCASTING ARTISTE LISTENS IN

Miss Carolyn Marsh, the Broadway singer, now broadcasting and playing in theatres in England is a keen radio listener, and is here seen with her new Cossor receiver.

"Filmusic"

AS a result of the popularity of the "Do You Remember These?" series of gramophone programmes a new series is being started on June 17th in the Western programme, which will be devoted to the most popular tunes from films of the last seven years.

A Variety Programme

HALF-AN-HOUR'S variety in the Midland Regional programme on June 18th. will consist of numbers by the Four Rhythm Boys, the close harmony quartet from Derby, and a number of Jack Buchanan songs arranged and played by "Nom" and "De Plume."

Morecambe Night

ANOTHER "Morecambe Night's Entertainment" is to be broadcast in the Northern programme on June 18th. This composite outside broadcast feature will include a programme by the Arcadian Follies from the Arcadian Pavilion; dance music by Lionel Millard and his Music from the Winter Gardens Ballroom; songs at the piano by "Hutch" (Leslie Hutchinson) from the Winter Gardens Theatre; and "The 1936 Frolics" at the Palace Theatre.

Piano-accordion Selections

SCHOFIELD EARL, who will give a programme of piano-accordion solos in the Midland Regional programme on June 19th, has broadcast in the Children's the artists in a concert to be broadcast from the studio on June 15th.

A Play with Music

ON June 20th. Martyn C. Webster is reviving "Ten a Penny," the play about a cabaret artist who was spoilt by fame. The book is by Geoffrey Bryant, which is the *nom de plume* of a West End actress now resident in Birmingham, and the music and lyrics are by Wilfrid Southworth, a Birmingham cinema organist who has broadcast. Hugh Morton and Marjorie Westbury are to play the leads again. There is a change in the instrumental music as compared with the original production; this time it is by Billy Merrin and his Commanders.

Revue Orchestra's Good-bye

THE Northern Revue Orchestra is to say "Au Revoir" to Northern listeners on June 15th, when it will broadcast its last concert of the season under the heading, "Goodbye in the meantime." It will probably be heard again in August.

Recital by Midland Artists

THREE well-known Midland artists will give a recital on June 15th. They are Miriam Licette (soprano), Webster Booth (tenor), and Mary Abbott (pianoforte). The vocalists will sing groups of solos and also a group of duets.

Variety of Theatres

MR. STANLEY DORRILL, managing director of the New Theatre, Oxford, will be interviewed at the microphone on June 16th in the Midland Regional programme by David Gretton, who is in charge of this series of outside broadcasts. There will be a strong variety bill from the theatre, including Sam Browne, the Three Rhythm Sisters, and The Two Leslies.

Novelty Programme

"BANANA SPECIAL," or from Jamaica to Covent Garden *via* Bristol, is the title of a feature programme to be broadcast from the Bristol Studios on June 15th. Listeners will hear a description by a planter of work on the plantations, and a description by a port loader of the loading work. There will be a ship's officer to explain the type of ship used to transport the fruit and later a forwarding superintendent will give a description of the railway work, and the fruit will be left with the warehouseman.

Military Band from Derby

DURING the summer months it is the intention to include in the programme military bands of repute from parks and public gardens in the Midland region, especially from the Jephson Gardens, Leamington, and the Arboretum, Derby. The band to be heard in the programme from Derby on June 17th is that of the 1st Bttn. Argyll and Sutherland Highlanders.

Organ Recital from Taunton School

THE eighth recital in the series entitled "Some Organs of the West Country" will be broadcast from Taunton School on June 16th. The organ was entirely reconstructed in 1933, but some of the oldest pipes were incorporated in the reconstruction scheme owing to their tonal beauty. The organist, A. E. Temple, studied at the Royal Academy of Music and has been Director of Music at Taunton School since 1932.

Welsh Regional Trio

THE Welsh Regional Trio—Frank Thomas (violin), Ronald Harding ('cello), and Hubert Pengelly (pianoforte), will broadcast in a twenty-five minute programme on June 12th.

SOLVE THIS!

PROBLEM No. 195.

Robinson constructed a mains three-valve receiver using a mains transformer having an L.T. winding designed to supply 4 volts at 6 amps. The heater consumption of the valves was 3 amps, and as anticipated the actual heater voltage was found to be too high. What should be done to reduce this voltage to the required 4 volts? Three books will be awarded for the first three correct solutions opened. Address your letters to the Editor, PRACTICAL AND AMATEUR WIRELESS, George Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 195 in the left-hand corner, and must be posted to reach this office not later than the first post Monday, June 15th, 1936.

Solution to Problem No. 194.

Edwards had forgotten to lock the drive to the gang condenser spindle.

The following three readers successfully solved Problem No. 193, and books are accordingly being forwarded to them: F. E. Wilson, 11, Rosebery Terr., Burley, Leeds, 4; W. H. Law, 77, Riddons Rd., Grove Park, London, S.E.12; V. G. Maitland, Mortlake Hotel, High St., Mortlake, Surrey.

ALL ABOUT MICROPHONES—2

In this Article the Condenser and the Crystal Types of Microphone are Explained, with the Principal Circuit Details.

By W. J. DELANEY

THE two types of microphone which were described last week may be regarded as the most sensitive of the general types, but sensitivity is not the main requirement of a microphone or microphone circuit. Fidelity is a most important feature, but this must also be coupled with the property of directional reception. That is to say, under certain conditions it may be necessary to ensure that the microphone only picks up sounds which emanate from one direction. Under other conditions it may be necessary to record equally sounds which come from all round the microphone. The most faithful

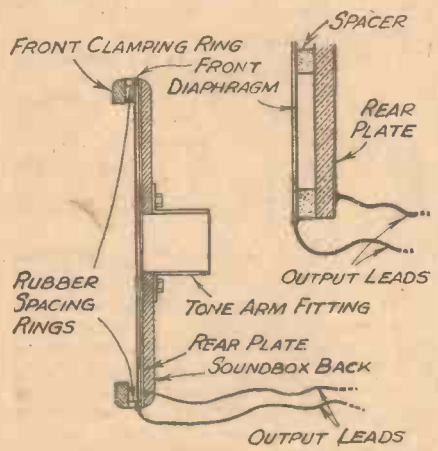


Fig. 1.—Suggestion for constructing a condenser microphone in a disused gramophone soundbox.

response is given by the velocity and the crystal microphones, whilst the condenser microphone (Fig. 3) is almost as good from this point of view. The crystal microphone may be constructed so that it is influenced equally from all directions, whereas the velocity and condenser instruments are directional, the former possessing the most marked effect in this detail.

The Condenser Microphone

This is the simplest type of the instruments just mentioned and will afford the experimenter the greatest scope for constructional and test work. As its name implies, it is actually a condenser, air forming the dielectric, and one of the electrodes being rigid with the other flexible or movable. As all amateurs are now aware, the movement of one plate of a condenser in respect to the other will vary the capacity, and in the condenser microphone the movable electrode takes the form of a very thin metal disc held at a very small distance from a back plate, and the sound

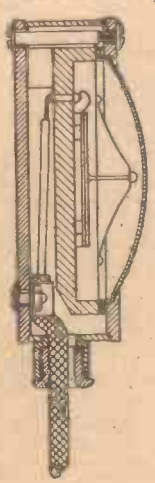


Fig. 2.—Diagram showing the principle of construction of the diaphragm-type crystal microphone.

waves are directed on to the thin diaphragm or upper electrode to form the varying factor.

It is obvious, from this description and a knowledge of the intensity of ordinary sound waves, that the capacity existing between the two plates must be extremely small (in most instruments it takes a value round about 50 $\mu\mu$F), and this forms one of the drawbacks to the general use of this type of instrument. Ordinary twin leads must be taken from the instrument, and capacity will exist between such leads. This capacity is in parallel with the capacity existing in the microphone and thus to avoid any effect on the microphone it must be kept extremely small. This means that the length of the lead must be kept down to an absolute minimum. In practice this is carried out by building a small amplifier on to which the microphone is mounted direct, and any length of lead may then be attached after the head-amplifier, as it is called, to convey the ordinary L.F. impulses to a larger amplifier for subsequent amplification. A suggested circuit is shown in Fig. 5.

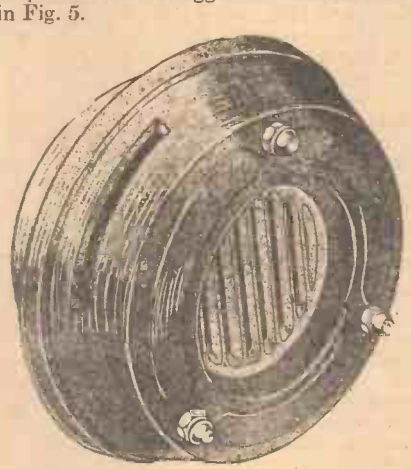


Fig. 3.—The Bulgin condenser microphone.

Home-made Units

A simple condenser type unit may be constructed by utilising the casing of an ordinary acoustic gramophone sound-box. The actual construction will vary according to the way the sound-box itself is constructed, but the rear part (where the normal tone-arm fitting is mounted) should

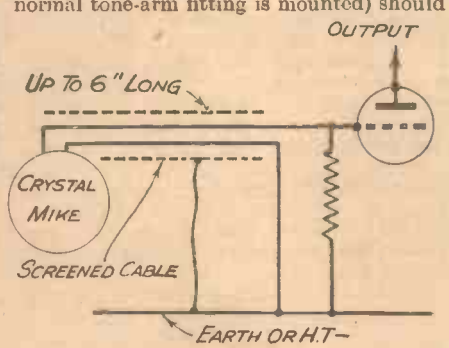


Fig. 4.—Input circuit arrangement for a crystal mike.

be converted into a solid plate, either by screwing a disc of metal to the existing back if this is of insulating material, or by just attaching a disc of metal over the ordinary back to close the hole existing there if metal is already employed. The mica diaphragm will be held in position between two rubber gaskets which are usually of thin tubing. Remove the outer clamping ring and take out the diaphragm and the two rubber gaskets, cutting one of these through its length or obtaining a thin flat rubber ring to take its place.

The mica diaphragm is then replaced by a thin disc of metal and a good suggestion for this is to use

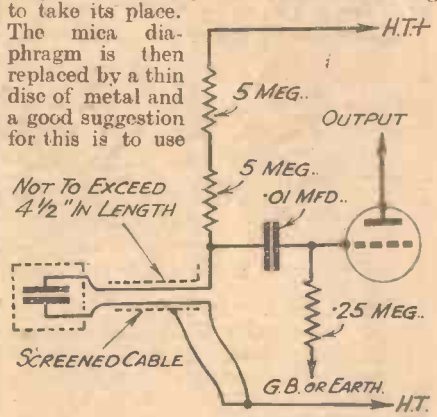


Fig. 5.—The makers of the condenser microphone shown in the centre of this page recommend this circuit for the head amplifier.

one of the thin discs of metal which are found inside tins of tobacco and which have to be cut out by means of a cutter inside the lid. The disc may be trimmed with ordinary scissors to make it fit the sound-box (Fig. 1). A disc of aluminium may be substituted for the tin-plate disc and other metals may be used for experimental purposes. It should be borne in mind that tin-plate will rust and this will affect the movement of the diaphragm, whilst paint cannot be used satisfactorily on the tin as a preventative as this will also affect the movement and lead to distortion. An alternative method of construction may be employed by using a discarded earphone case as mentioned for the carbon type of instrument last week. Lines of experiment may be conducted with the separation of the two plates as well as the method of mounting.

(Continued overleaf)

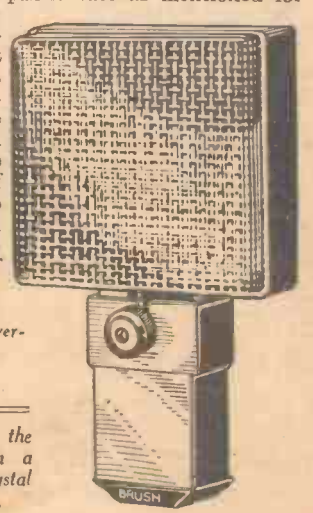


Fig. 6.—On the right is seen a modern crystal microphone.

(Continued from previous page)

The Crystal Microphone

In the crystal microphone a piece of piezo-electric material is employed, and the general make-up is as shown in Fig. 2. Modifications are found in the method of mounting the diaphragm, the material from which the diaphragm is constructed, and the method of mounting one or more units in a single case, with or without a diaphragm, to increase sensitivity and directional effects. A single bimorph unit with a duralumin diaphragm gives a slightly greater volume of output than the condenser type just referred to with about the same frequency response. Neither of these types gives such a great output as the carbon instrument, but this is, of course, offset by the increased quality, freedom from background noises and microphone hiss, and the fact that no battery has to be included in the microphone circuit for polarising purposes. As in the case of the condenser microphone, no input transformer is needed, and the instrument is joined direct in the grid circuit of the first valve of the amplifier which, to avoid losses due to long leads, should be mounted as close as possible to the microphone, again following the arrangement mentioned for the condenser microphone. To complete the circuit a parallel resistance of not less than 5 megohms must be used, and if any lower value is employed it will result in a shunting of the lower frequencies (Fig. 4). This may be turned to good account when it is desired to eliminate certain lower frequencies. The makers of this particular type of instrument recommend that where for any reason a cable of more than 30 feet must be employed between the microphone and the amplifier a transformer must be interposed and the primary winding should have an impedance of approximately 100,000 ohms.

This type of microphone is practically unaffected by temperature or climatic variations, and the output is constant and independent of frequency until the actual resonance of the crystal is approached. This may, of course, be adjusted by the makers to produce any desired effect dependent upon the use to which the "mike" is to be put. In the modern professional crystal microphone four of the above-mentioned units are employed and connected in series-parallel, the natural frequency being then in the neighbourhood of 41,000 cycles, which means that the response of the instrument would be to all intents and purposes flat up to 20,000 cycles. The length of lead recommended between this instrument and the grid of the first valve of the amplifier is not to exceed 6 inches.

The small head amplifiers which are recommended for use with these two types of microphone should preferably be entirely screened, and in practice one side of the microphone forms the metal case which may in turn be mounted direct on a metal disc enclosing the amplifier, and thus the "earth" lead shown in Figs. 4 and 5 may be ignored.

Practical Television

June 13th, 1936. Vol. 3. No. 6.

Michael Faraday and Television

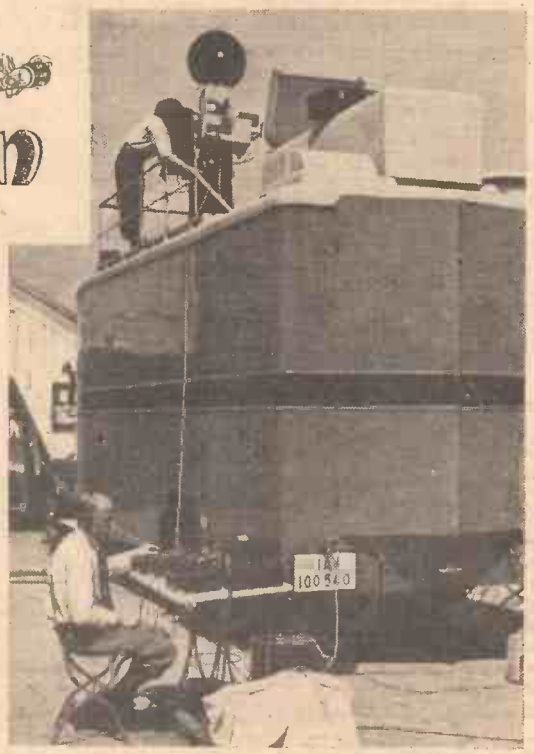
EVERY new radio or electrical development serves to emphasise the extreme importance of the work undertaken by Michael Faraday, the son of a blacksmith who lived from 1791 to 1867. When only twenty-two he was employed by Sir Humphrey Davy as an assistant in the laboratory of the Royal Institution. His famous discovery of electro-magnetic induction was published in 1831, and almost every year for the succeeding fifteen years he made known some remarkable discovery in connection with magnetism and electricity. Writers have always paid tribute to his lucidity, his experimental skill, and the natural charm of his manner which combined to make him extraordinarily successful as a lecturer. It seemed very fitting, therefore, that the subject of the Faraday Lecture before the Institution of Electrical Engineers on May 7th should have been "Television—An Outline." Without the discoveries of Faraday we may have been a very long way off from this year's autumn initiation of the B.B.C.'s high-definition television service from the Alexandra Palace.

Television Make-up

Now that the two lady television announcers and hostesses have been chosen and their names made public, quite a lot is being said about the degree of make-up required in order to fit in with the technical requirements of the television scanners. Owing to the peculiar colour sensitivity of the photo-electric devices employed for this purpose—photo-electric cells in the case of the spotlight scanner and photo-electric surfaces in the case of the electron scanners—it is found that red is not distinguishable in the final reproduced picture. In consequence facial details are more pronounced if blue replaces the more familiar red lipstick and rouge, while greater care has to be exercised in powder-shading the face. To say that the person looks grotesque when made up is, however, a travesty of the truth, and apart from the unfamiliar blue, an actor or actress looks but little different from any stage or screen star when performing. Of course, more attention will have to be given to the colours of dresses if the best results are desired, but this is a matter for experiment and rehearsal, and will in no way affect the final pictorial value as judged on the screen of the home television receiver.

Fluorescent Spot Speed

Although most readers have a reasonable idea of how the line traces are brought about in the raster observed on the fluorescent screen of a cathode-ray tube, very few appreciate the speeds with which the spot of light travels when carrying out its normal function in this way. This velocity is, of course, a factor of both distance and time, but by taking a concrete case it is possible to obtain a fair idea of the speeds involved. Not only does the spot trace out each scanning line in a direction from left to right over the available picture frame limits, but it has to fly back to the left-hand side of the frame in order to begin its trace of each succeeding line. Two speeds are therefore involved. Each line consists of a picture modulation and a synchronising modulation, and in practice it is quite usual to find that the flyback time occupies about one-tenth of the total trace time. With a 240-line picture reproduced at twenty-five frames per second on a tube having rectangular picture limits of twelve inches by nine inches, each line trace (scanning trace and flyback trace) would occupy 1/6000th second. In nine-tenths of this time the spot moves at a steady velocity across the screen to cover a distance of one foot, and neglecting the factor of slight line inclination in direction of scan or traces of curvature and assuming perfect linearity in the time base equipment producing the motion, it is easy to calculate that the picture trace speed is just over 4,500 miles per hour. To fly back over the same distance, however, a performance effected while the synchronising impulse has charge of the modulation so that this movement is not seen on the screen as it occurs in the "blacker than black" region, only one-ninth of the normal trace time is taken. The speed of the spot movement in this case is therefore over 40,000 miles per hour. The larger the size of the screen, or alternatively the higher the degree of definition in the picture, the greater the speeds of the fluorescent spot. When it is realised that the light intensity of the spot is being varied during this movement, the reader cannot fail to appreciate how wonderful is the operation of a cathode-ray tube.



General view of the Berlin Broadcasting Company's television reporter's van in operation. (Intermediate film system.) Note the sound engineer in the foreground.

A Seasonal Spring Clean—2

This Article Deals with the Overhauling of Earth Systems and Batteries. By L. ORMOND SPARKS

THE next section of the installation to receive attention is the earthing arrangement. This particular part of a receiving station has been—like aerials—sadly neglected in the past; but now that greater interest is being shown in short-wave reception, more consideration is being given to these two very essential items.

The Earth Lead

Starting with the actual earth lead which goes from the set to the earthing system, examine the wire at the set end and, if stranded flexible wire is in use, see that all strands are making good clean contact, and that the earth terminal, or socket, is free from dirt and corrosion. It sometimes happens that the strands fray out, and that these loose strands cause weird cracklings and complete absence of signals by shorting across the aerial and earth connections. If any doubt exists, cut off an inch or two, clean it well and then tightly twist all strands together, finishing the job off by fitting a reliable spade terminal or plug. If an earthing switch is used, repeat the procedure at that end, that is, if it has not already been done when seeing to the aerial side.

Now examine the wire, and when the set is in operation, pass the hands along the whole length of the lead, exerting a slight pulling strain, noting if any crackles are produced through the speaker. This test is best applied to, say, a foot at a time, gradually working along the whole length. If any suspicious noises are heard, probably some of the strands are broken, or the above suggestions have not been dealt with properly. In any case, don't leave the matter until the trouble has been traced, if necessary fitting a new length of lead.

If any joints have been made between the set and the actual earthing point, give them careful attention, and, if they are not of the soldered type, either make them so, or else use the small single connectors obtainable from all electrical stores. Remember that it is desirable to keep the resistance of the earth circuit as low as possible, therefore any poor or dirty joints must be removed, as they can offer quite a high resistance.

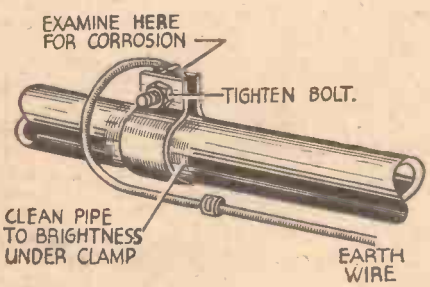


Fig. 1.—Clean the surfaces of the earthing clamp and pipe that come in contact.

Type of Wire, Bared or Covered?

While an earth connection can be made with any old type of wire, it is strongly advisable, in view of the above remarks, to use a reasonably stout flexible or stranded cable, particularly if the lead is likely to be a few yards in length. A very good cable is that known as 3/22 s.w.g., this being well insulated, and having a low resistance. If rubber-covered flexible wire is used, it is worth while investing in 14/32 s.w.g., as this is rather easier to work with.

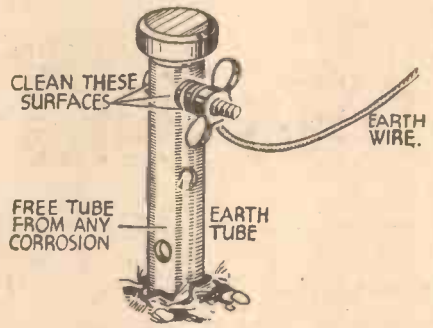


Fig. 2.—Earth tubes and connections should receive careful attention.

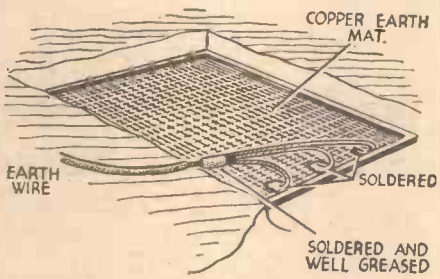


Fig. 3.—The only satisfactory method of connecting the leads to an earth plate, or mat, is by soldering.

Many views are expressed about whether the wire should be insulated or not; at the risk of starting a controversy, I would certainly suggest that it is better to use insulated, particularly where the receiver is of the mains operated type. Apart from any electrical considerations, a bare wire often introduces mysterious scratching and crackling noises into the receiver due, no doubt, to the surface making intermittent contacts with other earthed objects.

The Earth Plate

Whatever form of earth connection is in use, a thorough examination is advisable. If it is obtained through anchoring the wire to a water pipe, then the wire or clamp should be removed and all surfaces well cleaned. A word of warning is necessary at this stage; don't overlook the fact that lead pipes are very soft, so don't use a heavy or coarse-cut file for cleaning the surface. It is far better lightly to scrape the surface with an old knife. Cut off two or three inches of the wire, so that a fresh part is used for the new connection, and when everything is secure again, bind the job with insulating tape. If a soldered connection has been made, there will be no need to disturb it, providing all the strands are intact, and no corrosion is present (Fig. 1). Before remaking any connections it would be advisable to make sure that the pipe being used is the "rising main," and not the pipe from the storage tank, as the former provides a more efficient earth. Should one of the many forms of "earthing tubes" be in use, then pay particular attention to the connection, and look out for fractured wires and loose terminals. (Fig. 2.)

It is well worth while to remove the tube from the ground, to see that it is still intact, and that the earth around it has not caked into hard, dry lumps. The tube should be replaced in a fresh spot, and the ground around it well soaked. This applies in particular to clay soil, especially during the summer months.

The same suggestions apply to "earthing mats," and it is surprising what a difference in reception results when the system has been thoroughly overhauled. On no account should a twisted or terminal connection be used for anchoring the wire to the metal mat; a soldered join is the only satisfactory method. (Fig. 3.)

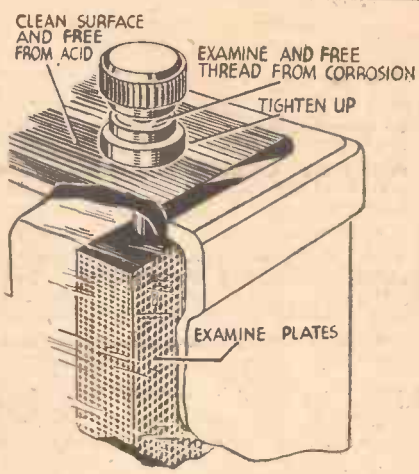


Fig. 4.—After well cleaning the terminals of an accumulator they should be coated with Vaseline.

Batteries

Having finished all the outside work, attention should now be paid to all batteries, particularly accumulators, and the time spent in that direction may possibly be the means of prolonging considerably the life of the cells.

Starting with the low-tension cells, the terminals must be well cleaned and all traces of corrosion or sulphating removed, lightly filing the terminal surfaces if necessary. Tighten any loose locking nuts, and if the terminal heads cannot be removed, owing to excessive sulphating, pour boiling water over them until they can be loosened without undue strain, afterwards cleaning the threaded shank and surfaces, and lightly coating them with pure vaseline. (Fig. 4.)

Next examine the cell for any signs of sulphating of the plates; this is easily visible in the form of a white paste, and if any is present it is advisable to have the cell treated at a reliable charging station. The same applies if excessive deposit is noted at the bottom of the container, as this should be washed out, and that job

(Continued overleaf)

A SEASONAL SPRING CLEAN

(Continued from previous page)

should also be done at the charging station. If a hydrometer is available, the specific gravity of the liquid or electrolyte should be checked. If the cell is in a charged condition, the S.G. should be 1.25, and if it is above or below this figure the cell either requires charging or topping up with distilled water. In any case, it is a good plan to have the cell washed out, refilled with fresh electrolyte, and given a long, steady charge at a low charging rate, if it has been in use some months. Such treatment, when carried out by a charging station of repute, does much to protect and lengthen the life of these batteries.

H.T. Accumulators

All the points mentioned for low-tension cells are equally applicable to those used for high-tension, but a little more care is required owing to the smallness of the containers and plates. Greater attention should be paid to the connecting links, plugs and sockets, or terminals, as it is very essential that every step should be taken to eliminate the possibility of any high resistance paths.

One item, which is not experienced to the same degree in L.T. cells, is the danger of the electrolyte "creeping" between cells or groups of cells, and particular attention should therefore be paid to the height level of the electrolyte, the fitting of the vent plugs, and keeping the tops of the cells free from moisture. A periodical wash out, fresh electrolyte and a really good charge are advisable, while doubtful cells should be rectified immediately or at least cut out of circuit.

If the cells are housed in crates or boxes, it is advisable to give these a little attention. They should be cleaned by washing them in hot water, to which a little ammonia has been added, thoroughly dried, and then given a coat of acid resisting paint.

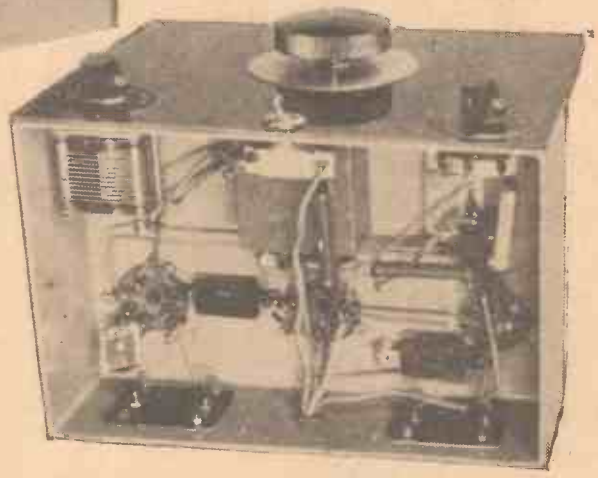
Dry Batteries

There is very little that can be done to the dry batteries, other than, of course, checking up their voltages with a reliable voltmeter. When applying this test, don't only read the voltage across the negative and maximum sockets, apply the meter to the intermediate tappings, and make sure that no section is cracking up. Readings should also be taken when the battery (H.T.) is in use, as the voltages registered on no load and full load are often very different, particularly if the battery has been used for some time, or if a heavier current is being drawn from it than that which it is designed to supply.

Should it be necessary for a new H.T. to be fitted, don't be penny wise and pound foolish by purchasing a battery that is too small as regards current output capacity, as its period of useful life will be very much less than that of a super-capacity battery, which, while having a greater initial cost, invariably works out cheaper in the end.

THE EDDYSTONE ALL-WORLD TWO KIT

THE new short-wave, two-valve receiver which has just been issued by Messrs. Stratton and Co. for home assembly is shown in the two illustrations on this page in completed form. This is a novel kit in several directions, the most important of which is the form of chassis which is employed. This is a die casting 8½ins. by 6ins. and 2½ins. deep, and this includes on the under side a short pillar which is used as an anchoring point for one of the condensers employed in the circuit. Holes for the valveholders and slots for the terminal connecting strips are provided in the casting, and these components are attached to the chassis by means of nuts and bolts. The complete kit includes the necessary connecting wire and screws in addition to the components, which are very few indeed for this particular receiver. The circuit employed is a simple detector and L.F. arrangement, the detector valve being of the H.F. pentode type, and the coupling between detector and L.F. valve being of the resistance-capacity type. A six-pin coil is employed for the aerial circuit, and this is tuned by a microdenser fitted with a slow-motion gear. To operate this condenser one of the well-known Eddystone two-inch knobs is employed with a travelling cursor which passes over an engraved aluminium dial, and a band-spread condenser is mounted beneath the chassis and provided with a ten-section divider plate. It will thus be seen that this combination takes the form of the band-spread tuning unit which was reviewed in our issue dated April 18th last, and which provides, in effect, a reduction gear of 90 to 1.



In the above illustration the receiver is seen ready for use, and on the right the completely wired kit is seen from the underside to show the neat arrangement of the component parts.

Circuit Details

The aerial is connected to the primary winding of the coil through a small "preset" condenser which may be adjusted when setting up the circuit to the best value (it can only be adjusted from beneath the chassis). The usual grid-leak and condenser connections are adopted, but the screening grid of the detector valve is connected to the arm of a potentiometer joined across the H.T. circuit so that the best value may be found on test. The reaction circuit is completed through a pre-set condenser, the adjusting screw of which is immediately beneath a hole in the upper surface of the chassis, and thus it may be adjusted to such a value that the control of the screening-grid potential will provide the reaction control and this gives a very smooth arrangement which is even better than the normal capacity controlled reaction circuit of a triode valve. Added to this, there is an increased amplification which is very useful in a small receiver of this type.

Test Results

The receiver was tested on our normal aerial and gave very good results. The principal feature which was noticed was the effectiveness of the reaction control, which functioned noiselessly and smoothly, giving a gradual build-up from the weakest signal to smooth oscillation when the pre-set condenser was correctly adjusted. The receiver was very free from hand-capacity effects. The effectiveness of the band-spread tuning combination enabled stations to be located as easily as on a standard broadcast receiver, and the All-World Two will provide the listener with hours of interesting entertainment at all hours of the day. The price of the kit is £3 7s. 6d., and two valves for the receiver will cost 20s. 6d.

SPECIFICATION

KIT: All-World Two Assembly.

DETAILS: Detector and L.F. circuit with single 6-pin plug-in coil which may, of course, be changed for any desired wavelength. All metal die-cast chassis, with paxolin panel and modern low-loss components. Band-spread tuning adopted in the aerial circuit.

CIRCUIT: Pen. grid-leak detector with resistance-capacity coupled L.F. stage. Reaction controlled by varying the screening grid voltage, with pre-set reaction condenser in usual circuit. Interchangeable plug-in coils.

PRICE: £3 7s. 6d. (plus 20s. 6d. for valves).

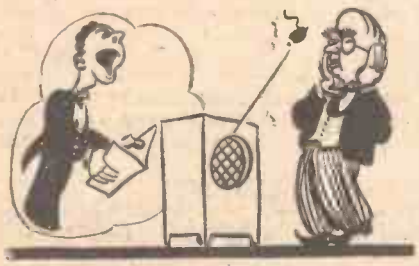
MAKERS: Stratton and Co., Ltd., Eddystone Works, Bromsgrove St., Birmingham, 5.

On Your Wavelength

By Thermion

Where are the Portables?

ALTHOUGH there must be many thousands of portable wireless receivers, you seldom see them in use out of doors. Why is this? The problem of weight has been solved, and you could obtain and make a wireless receiver satisfactory in every way and weighing only a pound or so. You do not see hikers with portable receivers slung around their shoulders, tennis players waiting for a court do not listen to the tuneful strains of radio, and only seldom do you see them in use on the river. Campers seem to have missed the delights of portable radio. Perhaps the manufacturers have not made too much noise about portable receivers, and only a few of them now include them in their catalogue. Is the public awaiting an even smaller portable? If so, I fear they will wait for a very long time.



Very few amateurs are worth broadcasting.

Amateur Turns

I SEE that there is a movement afoot for an amateur hour. I do hope that they will be at least as good as some of the amateur turns we are accustomed to hear from the Continent on Sunday. Amateur performers can be very good while they have their friends as a tolerant audience, but very few indeed are worthy of broadcasting to millions of listeners. Anyway, the B.B.C. have been blamed quite often enough for unemployment among musicians, so why throw more out of work? We are all aware of the amateurs who think they are as good as Melba or Caruso, and who feel quite hurt when you tell them otherwise. So many amateurs are misled by the misplaced flattery of partial friends, and it is unwise to pander to the vanity of those who do not earn their living as professional entertainers.

At the Seaside

I SPENT a pleasant week-end at the seaside this Whitsun, and a few days before the voracious landladies were preparing for the expected crowds. Actually the place was deserted at Whitsun, but previously a gang were busy testing the amplifiers for the P.A. outfits at the swimming pool. Decibels were not in it. I have no doubt they need at least 10 kilowatts output to shout down the noise of the bathers, but as the place was deserted during the test the music could be heard miles away. On the whole the reproduction was good, and while the records were of military band standard the effect was remarkably pleasing—but crooners ?????? !!!!-------..... ((((((()))))))) %%%%%%;;;;;;; and at that volume!

Sentimental Stuff

WHILE I am dealing with c——s, did you hear about a certain New York broadcaster who always concludes his turn with "Good night, Mother," for he knows that way over at Maryland his mother is listening? The authorities have told him to cut out the "mother," but he has refused, saying that his mother has been his most appreciative audience since he sang in Sunday-school. So there is a deadlock, and until the authorities give way and allow him to use the term "mother," broadcasting will have to struggle along without his aid.

Twelve Years Old

I RECENTLY heard of a man who has been using the same valve for twelve years and now complains that the sound is getting faint. He asked me what he should do about it, and omitting the rude answers I suggested that he might try the old dodge of disconnecting the H.T., leaving the L.T. on overnight, to effect some measure of annealing the filaments. It is a surprising thing that these early valves should last for twelve years, and upon returning home I probed my lumber room and unearthed some of my early valves. As a joke I tried them in a set, and found that they yielded really good results still. I shall be interested to hear from readers as to similar cases of valve longevity.

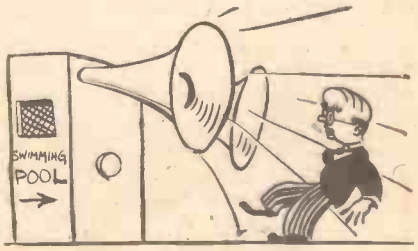
Big Ben

CAN anyone inform me why we should continue to listen to Big Ben at midnight? Why is it that this ancient time piece is not speeded up? When is 12 o'clock by Big Ben, when the chiming starts, half-way through it, or at the end? It takes over two minutes for it to register midnight. Has its sphere of usefulness as a timepiece ended, remembering that we get the six pips from Greenwich several times a day? This latter has made people watch conscious, whereas formerly they were content with a watch which lost or gained five or six minutes a day. Manufacturers of cheap watches tell me that the time signals have seriously affected their sales. Personally, I am proud of my watches, and like to see the second hand at the sixty when the six pips arrive.

Praise

AS a change from kicks—praise! This time from D. E. N., of Stafford:

"Dear Thermion,—Allow me to congratulate you on your articles in PRACTICAL AND AMATEUR WIRELESS. I have been reading them since 1932, and I am confident that you are the best writer on radio that has ever been, or ever will be. Your column on announcers this week—it's stupendous, terrific, marvellous, in fact, it is d—d good. You hit the nail right on the spot. They are, as



Kilowatts of crooner.

you say, hopeless. When you listen to American announcers you can hear the difference. They put atmosphere into their voices. Now for Dickens and Co. You are right again. There are plenty of modern writers who are not getting their due. Those bells, how I hate them. I can hardly keep my pen steady. There are some fine interval signals on the Continent, one I have in mind is from a German station. Now, Thermion, this is where I start pulling you to pieces. I have a perfectly normal mind, tested and found O.K., but I like crooners! This is where we differ." It is said that all great minds think alike. Still, 'nough said.

The Wireless Exhibition

I WAS glad to learn from your Editor (and mine!) that the PRACTICAL AND AMATEUR WIRELESS Stand would occupy the same site as in previous years. I am looking forward with great interest to this year's Exhibition, because, in the first place, Television apparatus will be on show, and secondly, because I want to renew my acquaintance with as many friends who know me not by my pen-name, but by that of my forbears. I have never ceased to be amazed at the thousands of readers who immediately upon entering the

His mother his best audience.

exhibition make a bee-line for our Stand and enter into conversation with our staff. There are many who like to shake the hands of the staff and the Editor, and not a few autograph hunters are among the junior section of our readers. For me there is the safeguard of my anonymity, and I can perambulate in safety, and free from the lionising which comes from fame. Only the other day your Editor drove his little £20 car into Gamages. I expect you remember that he designed this, and described it in our companion journal, *Practical Mechanics*. He was spotted, however, and was surrounded by a crowd asking questions. It was difficult to escape. By the way, if you are passing Messrs. A. W. Gamage, Ltd., in High Holborn, you should look into the motor department and inspect this fascinating little vehicle. If you can build a wireless set you can build this car.

Speaker Energising

IN most commercial receivers the speaker field winding is energised by the total anode current taken by the valves, the winding being connected between the common H.T.+ terminal and the rectifier. In this position the winding acts as an efficient choke. When a set is home-constructed, however, it often happens that the total current taken is more than the speaker winding is designed to pass, and in other cases the smoothed voltage is only just sufficient to feed the anode of the output valve. In such cases a different position must be found for the field winding. It may, of course, be connected in the H.T.— line instead of the + line, but this alteration will not alter the amount of current passing and therefore the effect will be the same as with the + line connection.

Field Winding as Bias Resistance

Some speaker windings are suitable for use instead of bias resistances, and when used in such a position no loss of voltage occurs. For example, a speaker having a field winding resistance of 1,500 ohms could be used for biasing low impedance valve types requiring 100 volts bias, and passing an anode current of approximately 55 m.a. Speakers having a field winding resistance of between 6,000 and 7,000 ohms, on the other hand, are very suitable for connection in the common anode lead to the first valves of a receiver using a 400-volt valve in the output stage. The smoothed voltage in such receivers is approximately 450 volts, and therefore has to be dropped to between 200 and 250 volts for the H.F. and L.F. valves. If these valves are arranged to have a consumption of about 35 m/a. a 6,500-ohm speaker winding can be used in place of a dropping resistance, and when used in this way it provides very effective smoothing for the voltage applied to the first valves, thereby reducing hum to a minimum.

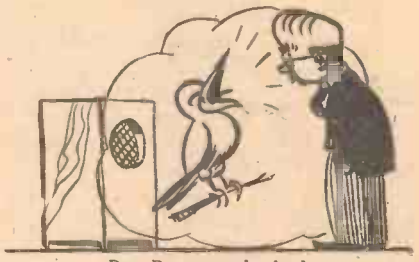
Double-diode-triodes.

THE double-diode-triode valve is very suitable for use in quality receivers in place of the normal power grid reacting detector. The substitution provides a slight increase in volume with improved quality. As most quality receivers have one or two straight H.F. stages without A.V.C., the two diodes of the double-diode-triode can be strapped together, with the tuned circuit preceding the detector connected exactly in the same manner as with a power grid valve in use.

The substitution has one disadvantage: selectivity is reduced as the reacting circuit associated with the power grid detector is not made use of. In the quality receiver this should not matter, however, as a low degree of selectivity is desirable in order to obtain good treble response. It is also usual for the H.F. stages to be on the verge of oscillation when the H.F. volume control is set at maximum, and, therefore, detector reaction cannot be used to the same extent as in a receiver having a detector as first valve.

Surprises In Store?

I WONDER if there will be any great surprises at this year's Wireless Show? It would seem that the limit has been reached in tuning dials and cabinet shapes, and I suppose we must look to television to provide the real changes, for changes there undoubtedly will be. Very few of us know very much about ultra-short-wave technique, and as the wavelength of the vision and sound transmission will be of the order of 7 metres, I envisage a complete change in radio design to meet the difficulties of this wide frequency band. The difficulties are accentuated by the lack of experimental transmission, and I fail to see how manufacturers can be ready by August with satisfactory television receivers unless they have been conducting experiments in secret. But I understand that such is not the case, and many of them are bemoaning the fact that they will be penalised owing to the attitude adopted by certain patentees. I do not think that they have real cause for grievance here, however, for the very good reason that the report of the Television Committee provided ample powers for disputes con-



Big Ben gets the bird.

cerning patents to be settled by arbitration. It is a fairly simple matter to arrange television receivers so that they can be switched over from the Baird to the E.M.I. System. I cannot see how such switching can be arranged to suit other television receiving systems, particularly the mechanical ones. I would not go so far as to say that mechanical scanning systems are dead, for there is plenty of room for invention, but I have had experience of both systems, and it would seem to me that the Cathode-ray Tube with its associated time base is the fundamental solution to television problems. It may not be perfect, but it has the elements of perfection in it. The scanning disc served its purpose in demonstrating its own shortcomings, and diverting attention to better methods.

A PAGE OF PRACTICAL HINTS

SUBMIT YOUR IDEA

READERS WRINKLES

THE HALF-GUINEA PAGE

Low-capacity Variable Condensers

RECENTLY I needed a small variable condenser of approximately .00015 mfd. maximum capacity, and not being able to find the desired type among my spare parts, I used a .0003 mfd. differential and a .0003 mfd. fixed condenser connected as shown in Fig. 1.

It is evident that when the moving vanes (C) are completely interleaved with fixed vanes (A) we have two .0003 mfd. condensers in series giving a value of .00015 mfd. in the maximum setting. As the moving vanes approach vanes B, the over-all capacity will be somewhat less than that produced between vanes A and C, owing to the series capacity of vanes B and fixed condenser in parallel.

Other values may be arranged by varying the value of the fixed condenser, but the maximum capacity of the differential condenser cannot be exceeded.

Another method of adapting a differential condenser is depicted in Fig. 2, where the two halves are wired in series. This arrangement, however, gives duplicate minimum settings, and the maximum

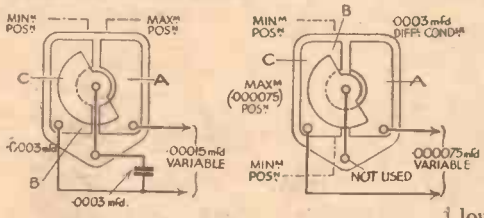


Fig. 1. Fig. 2.

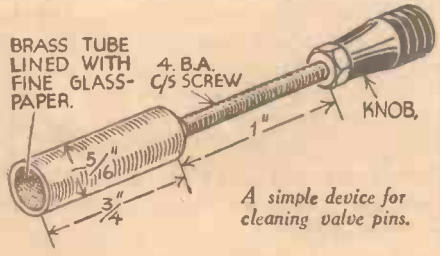
Arranging condensers for obtaining small capacities.

position occurs when vanes C are equally spaced between vanes A and B.

In this case, for instance, a .0003 mfd. differential condenser would give a maximum capacity of .000075 mfd., although the full capacity range would be obtained through 90 deg. rotation of the vanes instead of 180 degs. when using a circuit as arranged under the previous method.—W. A. HARRISON (Aintree).

Device for Cleaning Valve-pins

THE simple device for cleaning valve-pins shown in the accompanying sketch consists of a piece of brass tube 5/16in. outside diameter having a 4 B.A. screw soldered to one end. The inside of the tube is lined with fine surface glass-paper, and a knob is fitted to the end of the screw, as indicated, if the device is



A simple device for cleaning valve pins.

THAT DODGE OF YOURS!

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

used by hand. A speedier way, when a number of valves have to be dealt with, is to fix the screw into the chuck of a drill held horizontally in a vice.—FRED WILLAN (Southport).

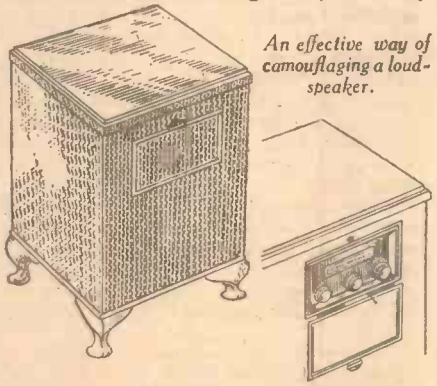
Camouflaging the Loud-speaker

ALTHOUGH considerable improvement has been made in set designing, the problem of the fretted loud-speaker opening still remains. One way of solving the problem is to use a woven fabric linen basket with a drop-front, as shown in the accompanying illustration. This type of furniture lends itself admirably as a radio cabinet for a bedroom.

Having obtained a suitable basket, remove the inside plywood lining below its drop front, and replace it with the loud-speaker on a baffle-board.

The woven fabric does not interfere with results, and completely screens the loud-speaker from view. The controls can be fitted to a panel and fixed inside, and when the front is closed everything is concealed.

That is the scheme in general, but many

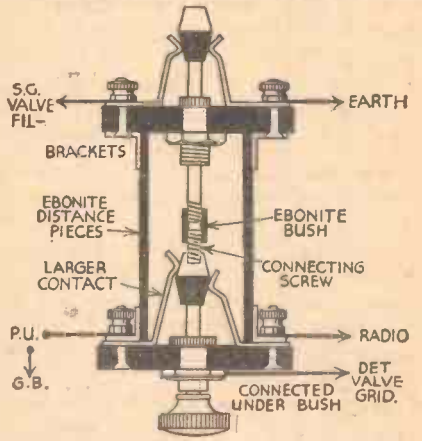


An effective way of camouflaging a loud-speaker.

ingenious readers will no doubt elaborate on this idea for themselves. This kind of cabinet is a part of modern bedroom furniture, and can be purchased at any furnishing store to match any particular colour scheme.—A. M. BALFOUR (Aberdeen).

Saving L.T. Current on a Radiogram

THE accompanying sketch shows a ganged push-pull switch which, when connected up as indicated, cuts off the L.T. current to the H.F. valve when switching on the gramophone. The larger contact on the gramophone section of the switch enables one part of the circuit to be independent of the other part, the two switch spindles being separated from each other and joined by an ebonite bush as

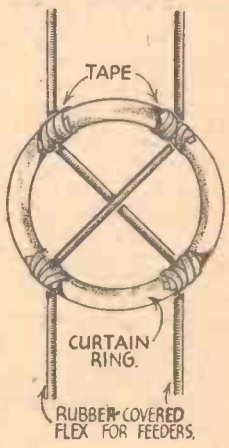


Method of adapting a push-pull switch for radiogram switching.

shown. Connection to the grid of the detector valve is made through the switch spindle.—R. A. WARR (Wellingboro').

An Inexpensive Doublet Antenna

WISHING to try out a doublet antenna for short-wave reception, but finding the commercial type of spreader for the transposed feeders rather expensive, I made use of the dodge illustrated in the accompanying sketch, which is self-explanatory. The curtain rings cost 1½d. each: they are wooden and are white-enamelled. The rubber-covered flex used for the leads is bound down to the spreaders with insulating tape, about 12in. being used for each joint. The antenna has been in use for some time, gives very good results, looks "professional" and shows no sign of deterioration in spite of indifferent weather.—L. A. KIPPIN (Romford).



An economical arrangement for twin feeders.

ITEMS OF INTEREST

Come to the Fair

IN some parts of Northern Ireland to this day there are still the old hiring fairs, at which agricultural labourers, servant boys and even servant girls display themselves twice a year for hire by farmers at an agreed price. The day of the hiring fair is a general holiday, on which the labourers can change their employment if they wish by means of accepting any offer they may receive from some other farmer. This method is strangely reminiscent of the slave market, except, of course, that the labourers sell themselves and are not the chattels of slave dealers. Hiring fairs naturally are occasions of some festivity, and on June 17 in a programme entitled "Come to the Fair," which has been devised by Jack Loudan with music specially written by Harold Spencer, listeners will be taken on an imaginary journey to one of these fairs. With the setting of a fair as a basis, the programme has been devised primarily as an entertainment, and the production will be by Edward Wilkinson. The music at these hiring fairs is provided as a rule in the local hall by the local ceilidhe band, which usually consists of fiddles and accordions. For the purpose of entertainment, however, these will be "augmented" by a piano and a 'cello, but the real spirit will not be lost.

Choral Concert from Midland Regional

THE Rainworth and District Male Voice Choir will pay a return visit to the studio to give a programme of part-songs, on June 14. Most of its members work in collieries in the Mansfield district of Nottinghamshire. The conductor, George H. Wright, began his career as a choirmaster at the age of seventeen; he was a deputy in the Rainworth colliery until recently.

Baird Television Limited: Change of Address

WE are informed that the Head Office of this Company has removed to Greener House, 66, Haymarket, London, S.W.1; Telephone No. Whitehall 5454; Telegraphic Address: "Televisor, Lesquare, London," to which address all communications (other than those dealing with purely technical and manufacturing matters), including invoices and accounts, should be sent.

Correspondence of a technical and manufacturing nature should be addressed to the Company's Laboratories at Crystal Palace, (Anerley Road Entrance), London, S.E.19, at which address the telephone number is Sydenham 6030.

Letters emanating from the Company will clearly indicate to which address any reply should be sent, and it should be noted that such replies *must be addressed to the Company* and not to individuals, otherwise unnecessary delay may occur.

"Jazz Pie"

HENRY REED and his Three Chefs are to broadcast a programme entitled "Jazz Pie" on June 19. This newly-formed combination of Manchester musicians includes Henry Reed himself at the piano and a guitarist, 'cellist and vibraphone player. They are to play Henry Reed's own arrangements of popular numbers such as "Who?" "Eeny Meeny Miney Mo," and "Solitude." The crooner will be Helen Clare.

"Cutting Loose"

IN the fifth of the series "Cutting Loose," on June 15, there will be a speaker who sought to cut loose from the daily round but was glad to get back to its monotony. This is David Kennedy, a schoolmaster in Northern Ireland. Anxious to get away from humdrum surroundings, he took a manual job on a boat sailing out of Belfast during his holiday. The adventures he met with as a pseudo sailor did not appeal to him, and he was very glad to return to his normal if somewhat prosaic occupation.

Contemporary Music Concert

THE eighth and last of the present series of Contemporary Music Concerts will be given in the Concert Hall at Broadcasting House on June 19. It will consist of a performance of Mr. Lennox Berkeley's Oratorio "Jonah," and Dr. Boult will conduct.

Musical Play

A LIGHT-HEARTED musical play, entitled "I scream Too Much," will be given in the National programme on June 16, and in the Regional programme on June 17. The music and lyrics are by Spike Hughes, and the play tells the story of a young opera singer and her career, which ends in triumph at the Cosmopolitan Opera House in New York, after she has made a success in Hollywood.

The story as written for the radio satirises not only the "Grand Operacket," but many features of modern life. Among these are the complicated rules and regulations of "bottle parties"; dance band announcers; the attitude of the popular Press to the "news value" of opera; American talent scouts and reporters; American sponsored radio (including the sponsor); Hollywood receptions to stars; and "In Town To-night."

B.B.C. Scottish Orchestra

THE B.B.C. Scottish Orchestra, which was formed in the beginning of December last year, has now been together long enough to develop into a really fine broadcasting combination. Led by J. Mouland Begbie and conducted by Guy Warrack, the Orchestra's permanent conductor, they will play, on June 18th, the Overture "Mein Heim," by Dvorak, and Ballet Music from "Gioconda," by Ponchielli, while George Fleming (baritone) will sing with orchestra, "Even bravest Heart," by Gounod, and "Within these sacred Bowers," by Mozart. Later Mr. Fleming will sing a group of three songs and the programme will conclude with the Overture "The Merry War," by Johann Strauss.

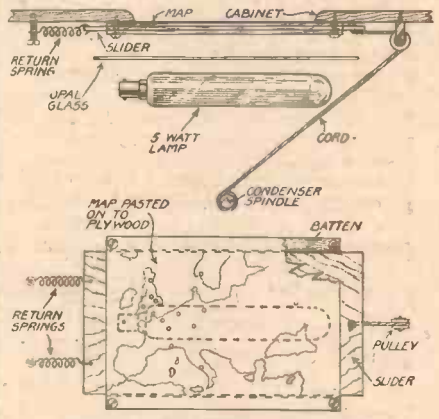
Norman Austin's Band

FOR more than two years Norman Austin and his boys of the Rutland Square and New Victoria Orchestra, Edinburgh, have been delighting listeners in the Empire and at home with their tuneful and well-chosen music. Until recently this programme was heard only on the National wavelength, but now it is being included in the Regional programme. Mr. Austin's programme on June 12th will include "The Merry Wives of Windsor," the fantasia "In Realms of Song," the novelty foxtrot "The Cocktail Dance," a selection "More Popular Hits" and "Jack of all Trades."

A "MAP TUNING" ARRANGEMENT

THE accompanying sketches show a simple method of reproducing the modern "map tuner." It consists of a map with a sliding screen behind which is fixed a low-consumption lamp with an opal glass screen. First a political map of Europe was obtained about 10in. by 18in. and pasted on a piece of plywood. When dry, two narrow battens were glued to the under-side, and finally the back was glued in position.

The slider, which is the same thickness as the battens, has an overlap of about 1½in. at each end, and must be an easy sliding fit without any side play. A hole was then cut in the cabinet about ½in. less than the map all round, to which it was fixed by four screws. One end of the slider was fitted with two light return springs, which were also held to the cabinet by screws, the other end having a cord which is taken over a small pulley to the condenser spindle, as shown in the sketch.



A simple "map tuning" arrangement.

After making all necessary adjustments a known station was tuned in and located on the map; then, taking a 1/16in. drill, a hole was drilled through the three pieces of plywood. This was repeated for the other stations on both long and medium wavelengths.

Care has to be taken that no two stations are in the same horizontal line or they will light up twice when tuning the dial. This was overcome by boring one hole above and the other below the name indicated; also, the distance of the slider was kept small, about 1½in., which reduces the risk of two stations running into one another. Other refinements will suggest themselves, such as placing small squares of coloured celluloid over the holes—red for all the British stations, and two other colours to distinguish between long and medium wavelengths.—K. W. CRANFIELD (Harrow).

INCREASED EFFICIENCY

This Article Deals with Various Simple Alterations which can be Made to the Receiver to Improve its Performance. By IDRIS EVANS.

DURING the long summer evenings the wireless set loses much of its popularity as a means of entertainment for the family, and therefore the next two or three months afford the enthusiast a good opportunity for trying out improvements on the old receiver.

Fitting V.M. Pentode

If the set is of the commonly used three-valve type, having one H.F. amplifying stage and one L.F. stage, it may have an ordinary S.G. valve as high-frequency amplifier, with volume controlled by means of the reaction condenser. This type of receiver is often prone to H.F. instability, and in cases where the aerial is situated near a transmitting station overloading of the detector valve may occur. An improvement may be effected by fitting a variable-mu pentode valve in the first stage. The degree of amplification obtainable from this type of valve can be reduced practically to zero by applying a bias voltage to its control grid, and this voltage can be varied according to the volume required by means of a variable potentiometer.

The easiest method of adding this type of control to an old receiver is as follows. Disconnect the lead at present joined to the grid terminal of the S.G. valve-holder and connect it to one terminal of a .0005 or .001 mfd. fixed condenser and then connect the other terminal of this extra condenser to the grid terminal of the valve. The centre terminal (connected internally to the moving arm) of the variable potentiometer should then be connected *via* a fixed resistance of approximately 500,000 ohms to the grid of the S.G. valve-holder, the two end terminals of the potentiometer being joined to H.T.— and G.B.—9 respectively. When this modification is made it is also advisable to substitute a three point on-off switch for the two point type; one terminal of this should be connected to earth and H.T.—, the second terminal to G.B.+ and the third terminal to L.T.—. Some of the modern H.F. pentodes have seven pins, and if one of this type is fitted the method of connection shown in Fig. 1 should be adopted.

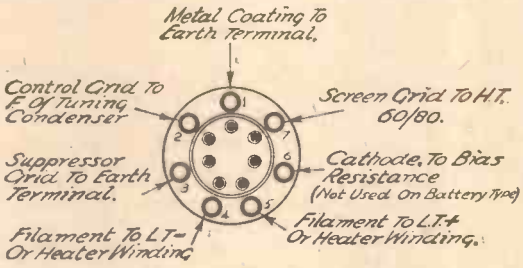


Fig. 1.—Standard connections for a 7-pin H.F. pentode.

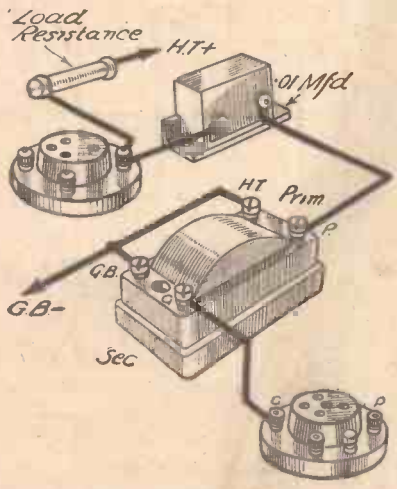


Fig. 2.—This method of connecting an L.F. transformer (parallel-fed) gives improved bass response.

Improving Selectivity

The selectivity of most old type receivers is inadequate for present-day requirements, but this may be improved without making drastic alterations to the circuit arrangement. The most effective method is to fit an extra tuned stage between the aerial terminal and the existing first tuned stage. This extra stage should consist of a coil similar to the ones in the receiver, and a .0005 mfd. tuning condenser. Unless the existing gang condenser is replaced by a new one having an extra section, the addition of the extra stage introduces the disadvantage of an extra tuning control. The easier method of improving selectivity by fitting a more selective coil between the H.F. valve and the detector may therefore be adopted. An H.F. transformer having a step-up ratio of approximately 3-1 can be relied upon to provide reasonably good selectivity if a well-designed reaction circuit is fitted. The cap terminal of the H.F. valve should be joined to one terminal of the primary winding of the coil, and the other primary terminal to H.T.+, the secondary winding being connected to the tuning condenser in the usual manner.

The L.F. Amplifier

After the H.F. amplifier has been satisfactorily modified attention should be paid to the L.F. stage or stages. The L.F. amplifier has more effect on quality of reproduction than the H.F. stages, and therefore if quality is inferior particular attention should be paid to the couplings and valves used in the former. If lack of bass is experienced the L.F. transformer should be parallel-fed as shown in Fig. 2. With this type of coupling no direct current is passed through the primary winding of the transformer, and therefore the primary inductance is higher than it would be if the primary winding were connected between the valve anode and H.T.+. Apart from improved bass response this method of connection also obviates the possibility of a primary burn-out.

L.F. Volume Control

If two L.F. stages are used, the addition of an L.F. volume control is very desirable in order to prevent overloading of the last two valves. The control should have a resistance of between 250,000 ohms and 1 megohm and should be wired as shown in Fig. 3. This control is particularly useful if a pentode valve is used in the output stage as this type of valve is easily overloaded. It can also be used as a volume control when the receiver is being used in conjunction with a pick-up for gramophone record reproduction.

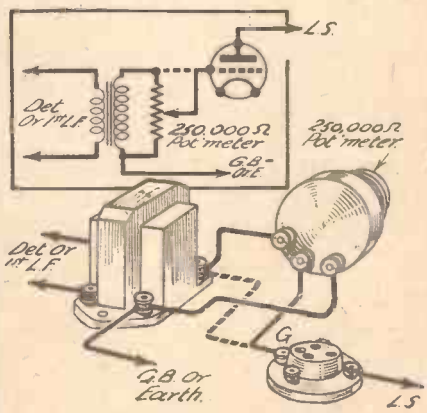


Fig. 3.—A simple and useful L.F. volume control.

A General-Purpose H.F. Unit

Practical Data for the Construction of a Two-Valve Unit which Can be Used for Increasing the Range and Selectivity of an Existing Det.-L.F. Receiver, or as a Complete H.F.-Det. Set.

By FRANK PRESTON

THERE are still many constructors who use a Det.-L.F. type of receiver, and although this is satisfactory for winter-time reception the range is generally too limited during the lighter weather. It is not generally a difficult matter to make an H.F.-amplifier unit for use with this for the purpose of increasing the range and providing additional selectivity, but there are several disadvantages in doing this. The most important is that there are two separate tuning condensers which have to be operated simultaneously, whilst another drawback is that the unit and the normal receiver have to be placed near together to make all controls convenient to operate; this tends to make the complete outfit untidy and inconvenient.

A Novel Arrangement

A method of overcoming all of the difficulties mentioned is to make a high-frequency-amplifier unit having a detector stage in addition to the H.F. valve. By following this arrangement—which has not previously been described—the constructor has the advantage of ganged tuning, whilst the unit carries all of the important controls, so that the existing receiver can be placed a short distance away and out of sight. Other advantages which are well worthy of consideration are that, when desired, the set itself can be used without the H.F. portion without any alteration being required, and the H.F. unit can be used as a complete receiver for 'phone reception of distant stations or for (rather weak) loud-speaker reception of the local transmissions.

Despite the fact that the unit has two valves, it is necessary only to buy one new one, because the detector valve from the existing set can be used in the second socket. This means that the tuning portion of the Det.-L.F. set is not used when the H.F. amplifier is being employed, but that the low-frequency amplifier is used exactly as before.

The circuit layout of the unit to be briefly described is shown in Fig. 1, and can be seen to follow conventional lines in most respects. A single tuning circuit is used prior to the H.F. pentode, the coil having a separate aerial winding. Variable-mu volume control is provided by means of a 25,000-ohmo ptentiometer, and H.F. transformer coupling is used between the two valves; the transformer provides a step-up ratio of 1 : 2, thus assisting the amplification afforded by the high-frequency pentode. Wave-change switches are shown in Fig. 1, but these are actually built into the coils, so need not be considered from the practical point of view.

Connection to the Set

It is the method of coupling the H.F. unit to the receiver which is unconventional, for a valve-plug adapter is used in the same manner as when using a short-wave adapter. It will be seen that the end of the H.F. choke in the detector anode circuit of the unit is joined to the anode pin on the adapter, whilst the two L.T. leads are taken to the filament pins. Thus, in order to attach the unit it is necessary only to transfer the detector valve from the receiver to the unit, and in its place insert the adapter plug. Aerial and earth leads must, of course, be transferred from the receiver to the unit. A separate lead is used for the high-tension supply to the first valve, because if the lead were taken to the anode pin of the adapter plug the current obtained would be through the transformer and de-coupling resistance in the detector anode circuit in the receiver. It can be seen that the H.T. supply for the screening grid of the first valve is obtained through a potentiometer consisting of two fixed resistances; this obviates the need for a second H.T. tapping. The H.T.+ wander plug provided should be inserted into the tapping on the H.T. battery which provides the full voltage, or, when using an eliminator, it may be connected to the main H.T.+ terminal on the receiver.

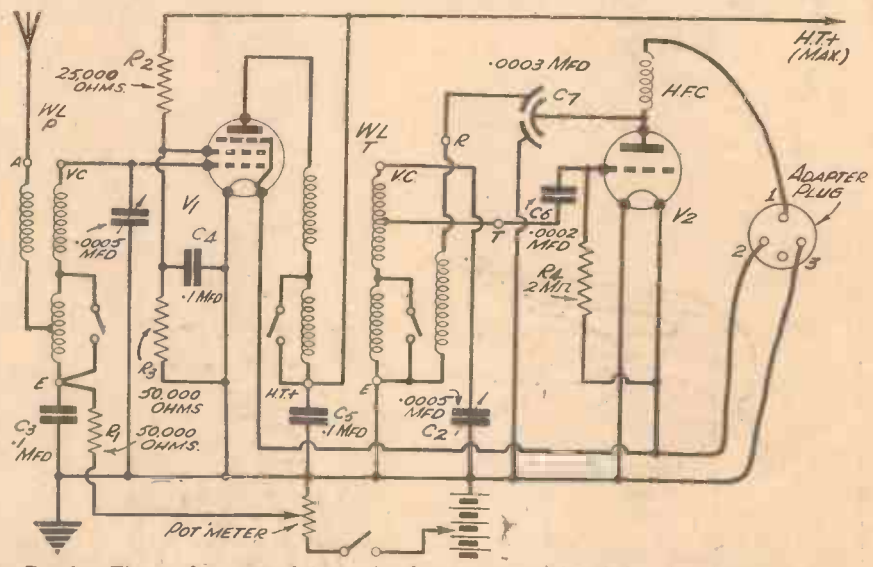


Fig. 1.—This is the circuit of the novel and convenient unit described. A wiring plan is given opposite.

It might appear that the H.F. choke in the unit would not be required, since this is provided in the set, but it is important that it should be used due to the fact that there might be a rather long lead from the unit to the adapter plug; in any case, however, this lead should not exceed about 12ins. In passing, it is worth while to note that the unit as shown can be used in the manner explained with any battery-operated receiver regardless of the type of coupling used between the detector and first C.F. valves.

Components and Layout

A list of suitable components for the principal positions is given elsewhere, and although alternatives would in many cases prove suitable those listed are known to be as satisfactory as any for the circuit shown, Items such as fixed condensers, potentiometer, fixed resistances and tuning scale are not included in the list, since those of any good make can be used with equal satisfaction. It is important, nevertheless, that the condensers and resistances be of the non-inductive type, which means that the condensers may be tubulars, and the resistances of the metallised or composition type. With regard to the potentiometer, particular note should be made of the fact that this is provided with a built-in on-off switch for the purpose of disconnecting the G.B. battery when the unit is switched off. The low-tension and high-tension supplies are controlled by the switch on the existing receiver.

Metallised Chassis

Component layout is perfectly straightforward, as shown in Fig. 2, a metallised chassis being used for mounting the parts. It will be clear that the potentiometer is mounted on a small component bracket, where it matches up with the knob of the wave-change switch, whilst the reaction condenser is mounted on the front edge of the chassis beneath the tuning condenser. It is very important that the bush of the reaction condenser should be insulated from the metallised chassis, otherwise the reaction winding of the second coil would be short-circuited, and there would also be a possibility of short-circuiting the detector H.T. supply. The condenser specified is fitted with an insulated

spindle, but if any other kind were used the bush should be mounted with insulating washers between it and the metallised plywood.

Wiring

The wiring is also shown in Fig. 2, and requires little explanation. The Wearite W.L.T.-type coil is provided with a connecting pigtail for joining to the anode of the H.F. pentode, and other terminal connections on both coils are lettered as shown in Figs. 1 and 2, instead of being numbered in the more usual manner. A few leads have to be passed through the chassis, and these should be taken through holes not less than $\frac{1}{8}$in. in diameter to ensure that the insulation is not scraped off the connecting leads when wiring up; the holes are numbered in the above- and below-chassis wiring plans.

In Figs. 1 and 2 the detector grid condenser (C.6) is shown as being connected to terminal T of the WLT coil, but it can instead be joined to terminal VC along with the tuning condenser. The latter connection is to be preferred when the utmost degree of selectivity is not required, or when it is found that the unit is inclined towards slight instability. The sensitivity of the unit is also slightly greater when using the VC connection. It is advised that the two alternatives be tried, final use being made of that which proves more satisfactory.

There is one little point concerning the connections to the adapter plug which should be mentioned: this is that the two filament leads must be arranged so that that numbered 3 is joined to the negative L.T. terminal in the receiver. This will also be joined to the H.T. negative lead and to the earth terminal.

Above and Below Chassis Wiring

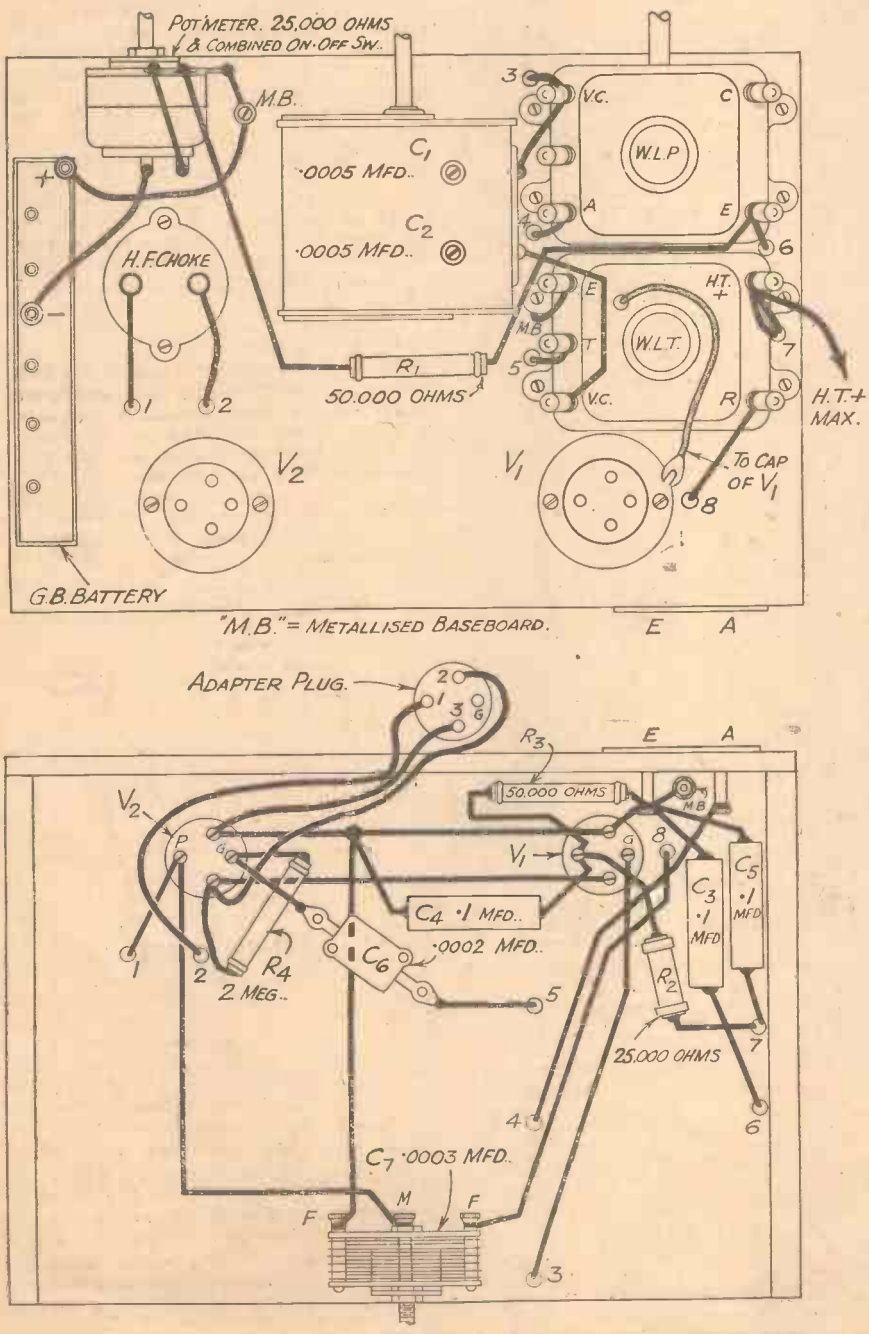


Fig. 2.—Wiring plan of the unit described and of which the theoretical circuit is given in Fig. 1.

Setting the Trimmers

The method of connecting the unit has previously been described, and a few simple notes on operation and preliminary adjustment will not be out of place. First set the reaction condenser in the receiver to its zero position, then switch on and tune in a station on about 250 metres. Reduce the strength of this by slacking off the reaction control on the unit and turning down the variable-mu volume control. When the signal is only just comfortably audible try the effect of slightly altering the settings of the trimmers on the two-gang condenser, meanwhile modifying slightly the setting of the tuning dial. As the signal strength increases, due to these adjustments, again reduce it by turning down the volume control, and then repeat the operation until the signal strength attains a maximum. The trimming should then be correct for all wavelengths, although it might be carefully checked at other parts of the tuning scale.

When switching off the set do not forget to turn the potentiometer to its "full-off" (anti-clockwise) position to ensure that the G.B. battery is disconnected. If this were not done the battery would be slowly run down.

As a Complete Receiver

In order to use the unit as a complete two-valve receiver, the lead marked 1, and shown as going to the adapter plug, should be connected to one side of the 'phones or loudspeaker, the other side of which is connected to a tapping on the H.T. battery. The lead marked 2 should be joined to the positive terminal on the accumulator, and that marked 3 should be taken to the negative terminals of both the accumulator and of the H.T. battery. If desired, a switch could be included in lead number 2 to act as an on-off switch; otherwise the set would have to be switched off by disconnecting the lead from the positive accumulator terminal. The method of using the unit as a receiver is just the same as that employed when it is used in conjunction with the L.F. portion of an existing set.

Good loud-speaker reception should not be expected from the two valves alone, due to the absence of L.F. amplification, but the strength should be sufficient for audibility in a small room when receiving local stations. The range on 'phones should be better than that of a good three-valver used with a speaker, which means that all the well-known European transmitters should be easily received.

PRINCIPAL COMPONENTS REQUIRED.

- One Peto-Scott Metallised Chassis, 10in. by 7in., with 2in. runners
- One J.B. 2-gang "Baby" Condenser
- Two Wearite Air-core coils, types WLP and WLT
- One J.B. .0003-mfd. Differential Reaction Condenser
- One Bulgin "Standard" screened H.F. Choke
- Two Clix Chassis-mounting 4-pin Valve-holders
- One Clix Terminal-socket Strip, marked A and E
- One Bulgin 4-pin Adapter Plug
- One Cossor 210 VPT H.F. Pentode Valve
- One Cossor 210 Det. or similar valve—the detector valve from the existing set can be used in this position

Random Jottings

By JACE

Another Television Staff Appointment

THE B.B.C. announces that Mr. Cecil Lewis has been appointed as producer of special programmes in the Television Department and will take up his new duties on July 1st. Mr. Lewis joined the B.B.C. in December, 1922, as Assistant Director of Programmes, later becoming Organiser of Programmes and Chairman of the Programme Board. Since leaving the permanent staff of the B.B.C. in July, 1926, he has been engaged in directing films, writing scenarios and plays, and he has also contributed to B.B.C. programmes.

Outside Broadcast Activities

A NEW sport introduced into the programmes for the first time this year is polo. Polo is a very dramatic spectacle in countries where the ground is hard. During the last few years in England the summers have been exceptional, and fast polo has been the order of the day at both Ranelagh and Hurlingham. This year will see the visit of the American International team, who are sportingly competing for the Westchester Cup in this country and not in America, as is their right. Another reason for introducing polo into the broadcast programmes is that this year it has been popularised and it will be possible to sit in the lovely surroundings of Hurlingham on a summer's evening and, for one shilling, watch the world's greatest exponents of the fastest horse game. It is hoped to have two experts broadcasting, one to describe the run of the game and the other to fill in with polo gossip between chukkers. The first broadcast is on June 10th.

The Wightman Cup introduces tennis into the programmes on June 12th, when a commentary on the play for this Women's International Trophy will be broadcast. Wimbledon opens on June 22nd, and each day the programmes will be interrupted for short descriptions of the progress of the tournament.

Hoylake this year entertains the world's greatest golfers for the British Open Championship. June 26th will be the critical day, and it is hoped to obtain the services of a well-known golfing journalist to enable listeners away from Hoylake to follow the fortunes of the final pair.

The first Test Match will be broadcast on June 29th.

Summer Games at Berlin

THE Olympic Games—an event of pre-eminent importance for athletes and sportsmen all over the world which takes place every four years—will be held this year in Germany from August 1st to August 16th. The B.B.C. will give a series of broadcasts of the games, and though precise details remain to be fixed, arrangements are already well under way. It is at present the intention of the Outside Broadcast Department to broadcast several evening bulletins from Berlin. These will include three or four of the principal track events, such as the 100 metres race, one or more swimming and rowing events, and perhaps some boxing. But as the list of entries for the various events are not at present available, it is impossible precisely to indicate which events will prove of most interest for British listeners. No special sporting commentators will be sent out from this country on behalf of the B.B.C. When it is known who will be going to the games, an attempt will be made to select experts on the various sports and to give them some instruction in microphone technique before they leave for Germany.

E.M.I. Service, Ltd.

THIS company point out that their attention has been drawn to the activities of a Mr. H. Braley, who represented himself to dealers and others in the West Country as an Operator No. 27 employed by this company.

E.M.I. Service, Ltd., hereby declares that at no time has the said Mr. Braley been in this company's service as operator or otherwise, neither has he received any authority to sell goods, execute work, or accept money on behalf of this company, and the company hereby disclaims any and all responsibility for his actions. Each of the firm's representatives is furnished with an identity card, and dealers are again requested to inspect this to satisfy themselves that the presenter is an authorised representative of E.M.I. Service, Ltd.

RADIO IN THE CITY

Jobbers in Throgmorton Street, London, E.C.2, watch the delivery of a Pye all-wave radio set. Will this be used to hear the Stock Market reports from Lyndhurst, Australia? Minutes count when shares are falling!

Summer Concert Parties

THE B.B.C. announces that several concert parties will be broadcast during the summer months. Harry Pepper is presenting the series which comprises broadcasts under the title "Shows from the Seaside," and other broadcasts of Harry Pepper's White Coons Concert Party from a London studio. In each of the programmes to be given by the White Coons a star guest artist will be included. Details of the concerts are given below:—

Week beginning June 14th: The White Coons, from a studio.

In the week beginning June 21st, G. P. Catchpole's Party will be heard from the Palace Court Theatre, Bournemouth.

Week beginning June 28th: The White Coons, when it is hoped that the guest artist will be Stanley Holloway, giving some of his favourite monologues.

Powis Pinder's show, "Sunshine," from the Summer Theatre, Shanklin, Isle of Wight, will be broadcast during the week beginning July 5th.

In the week beginning July 12th: The White Coons.

A concert party from Margate will be heard during the week beginning July 19th.

In the week beginning August 2nd, the Fol-de-Rols, from Hastings, Llandudno, and Eastbourne. This programme will comprise an hour's entertainment of three twenty-minute relays of the Fol-de-Rols' Concert Party at each of these resorts.

Week beginning August 16th: Jack Rickard's Concert Party from the Summer Theatre, Felixstowe.

The series will be closed with a relay of one of Blackpool's large concert parties in the week of August 30th.

In the case of "Shows from the Seaside" the broadcasts will be compèred by Harry Pepper and Dave Burnaby, either from Broadcasting House or, in some cases, from the side of the stage.

Lady Godiva Pageant

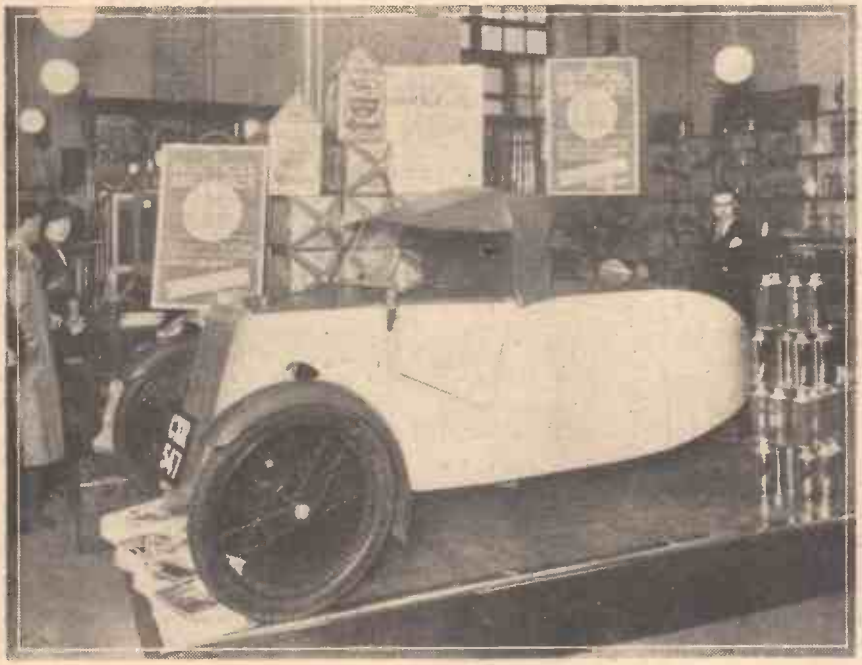
THIS spectacular event of nation-wide interest, which is being staged in Coventry on Saturday, June 27th, will describe in twenty-five fascinating episodes scenes from the lives of famous women throughout the ages, including Cleopatra, the Queen of Sheba, Helen of Troy, Boadicea, Queen Elizabeth, the wives of Henry VIII, Nell Gwyn, and Nurse Cavell, with the Lady Godiva as the central figure, presented by a cast of two thousand performers in a procession some three miles in length.

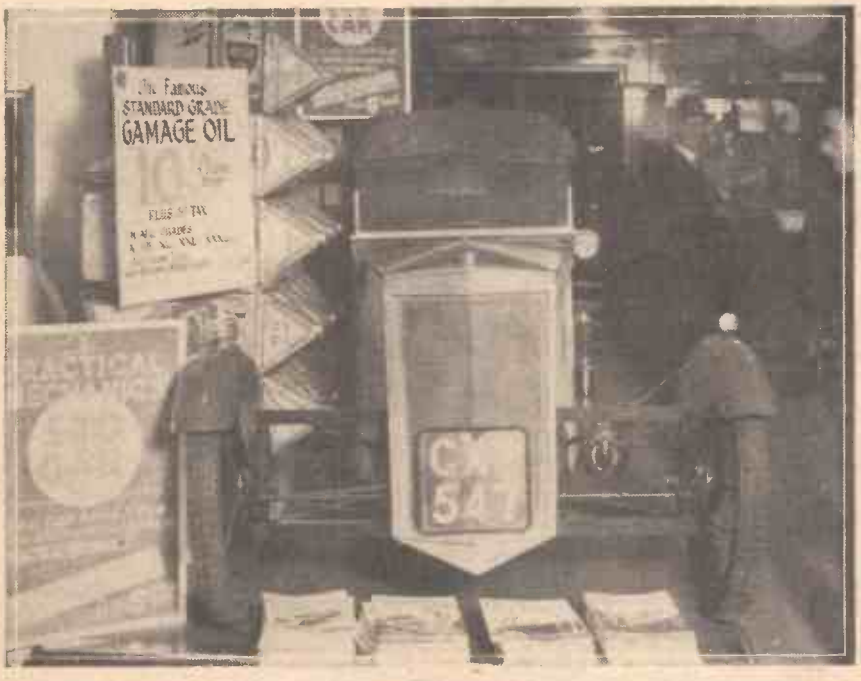
The Lady Godiva Procession of 1936 will be the most imposing carnival cavalcade ever produced in Coventry, and special excursions are being arranged from all parts of the country. A comprehensive range of supporting attractions has been engaged, outstanding among which is a thrilling display by the Royal Corps of Signals, who will repeat their Olympia triumphs in the Stadium. Other items include an athletic meeting, in which representatives of crack English clubs will compete for valuable prizes, a dancing enclosure for six thousand, and an original continuous revue entitled "Carnival Nights."

A complete catering service will provide for 150,000 guests, whilst ample parking accommodation will be provided. This pageant is organised in aid of the Coventry and Warwickshire Hospital, which is in urgent need of funds. Further information will gladly be supplied, upon application, from the Advertising Secretary, Ashleigh House, Much Park Street, Coventry.

A CAR YOU CAN BUILD FOR £20

READERS will remember that the Editor of this journal recently described in *Practical Mechanics* his ingenious little three-wheeled car which can be made at home for £20. Blue prints are available for home constructors. The two photographs below show the car in the showroom of Messrs. A. W. Gamage, Ltd., High Holborn, E.C.1, where it is attracting considerable attention. Readers of this paper should avail themselves of the opportunity of inspecting this wonderful little car at this famous store. The car is of 3½ h.p. and uses an ordinary motor-cycle type of engine and gearbox. It is sprung front and rear, steering being by the well-known Ackerman system. The car is capable of a speed of at least 50 miles an hour, whilst the petrol consumption is at least 60 miles per gallon.





Two views of the "Practical Mechanics" £20 car in the showroom of the famous store of A. W. Gamage, Limited.

SHORT WAVE SECTION

TUNED H.F. AMPLIFICATION

—And Details of an Interesting Circuit Including a Tuned H.F. Stage and Employing a Gang Condenser

HIGH-FREQUENCY amplification is not widely used in short-wave receivers, and many argue that an H.F. stage is almost entirely a "passenger," as far as range of reception is concerned. There is probably some justification for this reasoning when considering older-type valves and components, but experiment proves that the high-frequency amplifier can be made to provide a reasonable amount of amplification if it is accurately tuned; and this is in addition to other important advantages which cannot be denied. For example, all experimenters are agreed that a pre-detector valve definitely does minimise aerial effects, such as damping, wavelength variation, and the like, whilst it also has a considerable "smoothing" effect on reaction control.

Ganged Tuning

It is because of the latter benefits that H.F. amplification in the short-waver has previously been advised in these pages, and the advice given has generally been to use an aperiodic aerial tuning circuit feeding into the first valve, following this with the usual leaky-grid detector. One reason for this was that accurate tuning of two circuits simultaneously presented a rather difficult problem when coils were not made to the fine limits which is usual to-day, and when low-capacity gang condensers were rare. The position is different now, and it is by no means difficult to take advantage of all of the benefits of the untuned arrangement with the added ones of useful H.F. amplification and increased selectivity.

Tuning of two stages does not necessarily introduce the difficulties which are often imagined, chiefly due to the fact that really precision tuning of the aerial circuit is rarely important when the detector valve is provided with a reliable reaction arrangement. This means that a gang condenser of the newer double .00016-mfd. type can be used with complete satisfaction, whilst a further improvement can be had by shunting the aerial section of this with a very small—say 25 m.mfd.—trimmer. By following this idea stations can be tuned in with the gang condenser in the normal manner, after which signal strength can be slightly increased by careful adjustment of the trimmer.

Use of the Trimmer

It might be considered that the capacity of the trimmer in parallel with the aerial-tuning section would throw the two circuits out of balance, but this is rarely the case, because the capacity of the reaction circuit tends to raise the minimum wavelength setting of the intervalve circuit. In any case, if it is found that the trimmer has generally to be set to its minimum position, a very slight additional capacity can be added to the second circuit by connecting two short lengths of insulated connecting wire between the two ends of the second tuned circuit, and twisting these together.

Unorthodox Reaction Circuit

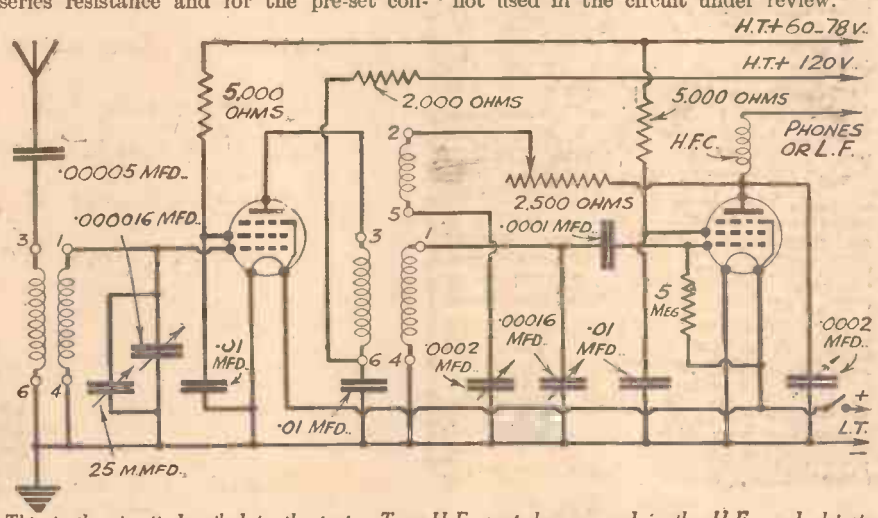
A circuit on the lines suggested is shown on this page, and although this might appear to be unnecessarily complicated it can often be simplified. The circuit reproduced, however, is of a rather "de-luxe" pattern including an unusual and special reaction circuit, the object of which is to make reaction almost constant over the full range of wavelengths covered by any particular coil. With this idea in mind there is, in addition to the usual .0002-mfd. variable reaction condenser, a .0002-mfd. (max.) pre-set connected between the anode of the H.F. pentode detector and earth, whilst a 2,500-ohm variable resistance is included in series with the reaction winding. This resistance, by the way, must be of the composition type, having the least possible value of inductance. By careful experiment, it is possible to find settings for the series resistance and for the pre-set condenser which cause the reaction control to be so constant that only very slight adjustment of the reaction condenser is normally required. It will generally be found that the capacity of the pre-set must be only slightly above the minimum, and that a resistance of about 1,000 ohms has to be kept in circuit.

Standard Six-pin Coils

The connections shown in the circuit are for standard six-pin coils, of which the reaction winding is not used for the aerial-tuning circuit. Coupling between the two valves is by means of the high-frequency transformer method, which is by far the best in most short-wave circuits. It will be seen that H.F. pentodes are used for both positions, and that the screening grids of both valves are fed from a separate H.T. tapping through 5,000-ohm fixed non-inductive resistances. The anode of the first valve is adequately decoupled by means of a 2,000-ohm resistance in the lead to the full H.T.-voltage tapping on the battery.

Those who wish to simplify the circuit can do so by using a triode in the detector position, but this is not as good from the point of view of simplified reaction control. It is also possible to dispense with the variable resistance and pre-set condenser, but these are valuable refinements.

It need scarcely be added that all of the fixed condensers must be of the non-inductive types, of which tubulars are most convenient. Other components are standard, whilst the valves may be of either the "plain" or variable-mu type; in any event the variable-mu characteristics are not used in the circuit under review.

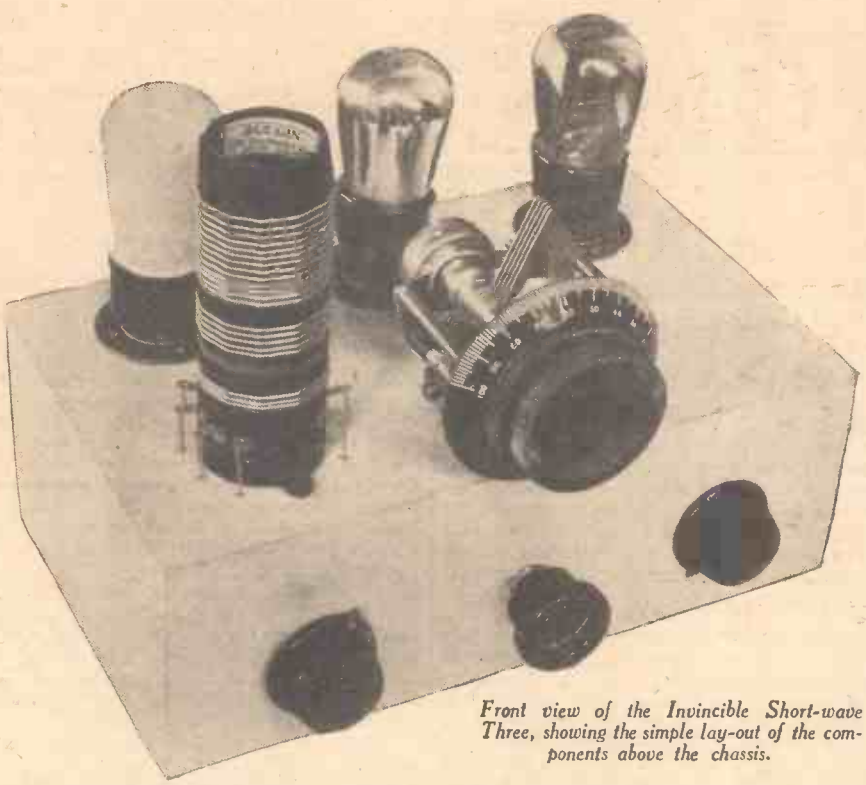


This is the circuit described in the text. Two H.F. pentodes are used in the H.F. and detector stages, whilst a rather complex reaction circuit is employed.

'Phones or L.F.

The output from the detector valve, through the H.F. choke, is marked as going to 'phones or an L.F. stage. If 'phones are to be used they should be connected between the choke and a tapping on the H.T. battery or, better still, through a 25,000-ohm decoupling resistance to the maximum H.T.-voltage tapping. In the latter case a 1-mfd. decoupling condenser should be joined from the junction of the

(Continued overleaf)



Front view of the Invincible Short-wave Three, showing the simple lay-out of the components above the chassis.

(*Continued from previous page*)

'phones and the resistance to earth, in the usual manner. The L.F. coupling, where the detector is to be followed by an amplifier, may be of any convenient type, although a parallel-fed transformer is most satisfactory in most cases, and the coupling resistance should have as high a value as possible, up to 150,000 ohms or so, in order to provide reasonable matching for the H.F. pentode. In that case it might be found possible to dispense with anode-circuit decoupling, but if not, the decoupling resistance should have a value not greater than about 25,000 ohms.

Stopper Resistance

In using ordinary transformer coupling the transformer should be a really good one with a high primary impedance; a small, cheap component would not offer a sufficiently high impedance. A 100,000-ohm stopper resistance should also be included in series with the lead to the grid of the L.F. valve, which should for preference be a pentode.

A three-pentode short-wave receiver built along the lines suggested will provide extremely good reception, and will be preferred by many to a superhet, which many short-wave workers do not like.

In any case, the arrangement described above provides ample scope for interesting experiment, particularly in view of the fairly high degree of selectivity provided—which is rapidly becoming of greater importance on the short waves.

Leaves from a Short-wave Log

ALTHOUGH since the beginning of May conditions have not been very favourable for hearing stations working on the higher sections of the short-wave band, in some instances encouragement to listen has been found in the fact that one or two interesting broadcasts were logged, and by so doing, definite information was obtained regarding the regular schedule of a newcomer to the ether.

The Belgrade short-waver (49.17 m.) has recently considerably extended its daily broadcasts. Coming on the air at B.S.T. 19.00 with a time signal and a concert, the entertainment consists of a series of news bulletins in various languages, such as French, German, Italian, Turkish, Greek, Magyar, and Albanian, interspersed with short talks, instrumental and vocal numbers, and gramophone records. Usually at 22.40 a twenty- to thirty-minute transmission of dance melodies is given, the station closing down at midnight (local time) with good-night greetings in many European tongues. Bear in mind that you will hear the call as *Rah-dee-owe Bay-owe-grad.*

Guatemala

Another new star on the horizon is TGIX, Guatemala City, on 31.75 m. (9,450 kc/s), terming itself the *Radiodifusora Nacional* in view of its close association with a Government department. Occasionally relaying the programmes of the medium-waver TGW in that city, the regular transmissions are advertised as B.S.T. 18.00-19.00; 00.30-01.30, and from 03.00-05.00 on week-days, with an extended transmission on Sundays. Hitherto broadcasts from TGW were taken by TGWA on 50 m., but this station has not been heard of late.

CEC, La Granja, Santiago (Chile), on 28.12 m. (10,670 kc/s), is also a recent capture by a listener in the British Isles. Heard on Saturdays and Tuesdays from about B.S.T. 01.00, a bugle was blown prior to all announcements, and it is reported that the station signed off with a fanfare of trumpets, the playing of the Chilean anthem, and chimes indicating the hour.

There is also a new transmitter at Colon (Republic of Panama) with the call HP5F, *La Voz de Colon*, working from the Carlton Hotel in that city on 49.34 m. (6,080 kc/s) daily from B.S.T. 01.45-04.00 and on Sundays from B.S.T. 22.00-00.00. It is owned the Sociedad publica de Radio, S.A Colon (Republic of Panama), to whom all reception reports are to be addressed.

Colombia

HJ5ABD, Cali (Colombia) has increased its power as well as its wavelength; it is now settled on 49.30 m. (6,085 kc/s). Broadcasts from this station are well heard between B.S.T. 02.00-04.00, but so far they have not been logged on Sundays; possibly the station only works on weekdays. Immediately below HJ5ABD, a transmission was recently picked up which was identified as one from a newcomer, or, at least, a new call at Bogotá (Col.), namely, HJ3ABX, on 49 m. (6,122 kc/s). It was announced as *La Voz de Colombia*, and the address noted was: Apartado 2,667, Bogotá.

The transmitter at Cartagena (Col.), working on 31.25 m. (9,600 kc/s), which has been reported in various quarters as bearing the call-letters, HJ1ABP and HJ1ABT is definitely HJ1ABD, and it styles itself the *Radiodiffusora Cartagena, Ondas de la Heroica.* The interval signal consists of three chimes on a rising scale Address: Apartado Postal. 252, Cartagena.

Costa Rica

TIGPH, San José, Costa Rica, is another broadcaster which has been lately fairly frequently received in the British Isles. Here identification has not been so easy, as although in the course of the transmission the call letters were clearly heard, reference was later made to TIX and *La Reina del Aire.* Apparently TIGPH is the short-wave channel of a medium-waver in San José which styles itself *Emisora X* or *La Reina del Aire.* It is on the air daily from BST 19.00-21.00, and again from 01.00-05.00, or even 06.00. The wavelength is 51.46 m. (5,830 kc/s); it is said to be using 1 kilowatt, and reports should be sent to "Alma Tica," Apartado Postal 775, San José, Costa Rica. This station is not without local competitors, as two others in San José have also been picked up from time to time. They are TIEP, *La Voz del Tropico*, on 44.71 m. (6,710 kc/s), which is said to S.B. on 80 m. (3,750 kc/s) and 526.1 m. (470 kc/s), and TI-RCC, *Radio-emisora Catolica Costarricense*, on 45.8 m. (6,550 kc/s). The address of the former is: Apartado Postal 257, and of the latter: Apartado Postal 40, both as already stated in the same city.

Honduras

A correspondent informs me that he recently logged HRV, La Ceiba, Honduras, on 48.11 m. (6,235 kc/s), giving out its call as *La Voz de l'Atlantica.* I have searched American lists and found a record of this transmitter but, unfortunately, without any further details.

Finally, YV12RM, Maracay, Venezuela, which has been operating for several months on 47.62 m. (6,300 kc/s) has abandoned its subsidiary call: *Emisora Vienticuatro de Julio* for the more formal *La Voz de Aragua.* Announcements are made in Spanish and English every fifteen minutes, and the studio broadcasts daily from B.S.T. 01.00-05.00. The address is Avenida Bolivar, 125, Maracay, Venezuela.

Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

Belling-Lee Anti-interference All-wave Aerial

ADVANCE details have just come to hand of the new anti-interference aerial system which has been produced by the research department of Messrs. Belling & Lee, and which is to be known as the "Eliminoise" anti-interference aerial.

Briefly, the equipment consists of two matching transformers designed for optimum efficiency from 15 to 2,000 metres, and these wave ranges are covered without the use of switches. The usual type "C" screened twin cable is used, and this feature makes the "Eliminoise" unique.

The fitting of the transformers at top and bottom is made a simple matter and the necessity for soldering has been avoided in a soundly practical way, and these points will find favour with many installation engineers.

Fullest details of the efficiency of the equipment as a whole are not yet obtainable, but we understand that the drop in output over the whole wave range is of the order of 4 d.b., and this is definitely negligible on the average receiver that is on the market to-day. In fact, on many receivers employing automatic volume control the "Eliminoise" would have the effect of increasing the output on distant stations which were affected by interference.

We shall be publishing official test reports of the efficiency on all wavelengths in the near future when its performance can be readily appreciated; those who have had experience of the Rejectostat will be able to judge by the fact that the "Eliminoise" is at least as efficient in every way on medium and long waves as the Rejectostat, and this efficiency is maintained on the short waves.

The "Eliminoise" will not be available for four to five weeks.

The price of the kit of two transformers, without cable, has been fixed provisionally at 37s. 6d.

The New R.A.P. "Regent" All-wave Superhet

CENTRAL EQUIPMENT LTD., a firm already phenomenally successful in other fields, adopted the Lease-a-Radio system because they were convinced that this method was the ideal means of giving maximum satisfaction to the public at the lowest possible cost. The Company made radio history three months ago by opening a chain of depôts round London with a central office in the West End, and the public response has been so far greater than anticipated that new depôts are being opened up in a number of districts to cope with the rapidly-increasing demands. It followed naturally, therefore, that having demonstrated the great demand for Lease-a-Radio in the London area the ever-progressive designers of R.A.P. receivers and radiograms would set themselves the formidable task of producing the most up-to-date all-wave set in this country, and the R.A.P. "Regent" All-wave Superhet is the result of their efforts. Its designers claim that this superhet, with its many new features, is at least a year ahead of anything of its kind yet produced in Great Britain. They make no apology for incorporating the best American, as well as British, ideas of design.

Outstanding Features

The R.A.P. "Regent" All-wave superhet is an eight valve (A.C. or A.C./D.C.) all-wave super-heterodyne (two short and medium and long waves), covering four wavebands and having an output of 6 watts. Among the many new features incorporated in the "Regent" are:—

Keyed Colour Coding, which enables even a novice accurately to tune to any desired station on all wavebands; "Fader" type volume control; Inter-station noise suppressor; and Litz-wound coils, etc. A twelve-inch "concert grand" moving-coil loud-speaker is incorporated, and reproduction is of a very life-like quality. The Receiver is housed in a handsome walnut and macassar cabinet of unusual and striking design.

Specification

Tuned pre-selector input circuit followed by a variable-mu H.F. Pentode operating as a radio-frequency amplifier on all wave-bands, followed by another H.F. Pentode operating as the mixer valve. A separate triode oscillator is coupled to the suppressor grid of the mixer to generate the local oscillations. This is followed by four tuned circuits and a further H.F. Pentode which constitutes the I.F. amplifier stage. Distortionless diode rectification, A.V.C. and audio-frequency amplification is obtained from a multi-purpose valve. This is coupled by means of a high-quality transformer to two pentodes, operating in push-pull, which delivers approximately 6,000 milliwatts of power to an energised moving-coil loudspeaker. Provision for external loudspeaker. Volume and tone controls operated on pick-up which can be left permanently in circuit. Wave range: 16-51 metres; 44.5-150 m.; 200-550 m.; 750-2,000 m.

What It Costs

The cost of the R.A.P. "Regent" All-wave Superhet under the Lease-a-Radio care-free system is extremely low. It can be obtained for an average weekly rental of only 3s. over a period of three years. Renters have the option to purchase or cancel at any time and after three years' leasing the receiver automatically becomes their own. During this time uninterrupted radio listening is guaranteed. Free service is at users' disposal at all times and free replacement is made when necessary of all spare parts and valves.

The monthly charges are:—

1st year.....16/- monthly
2nd " ..... 12/6 "
3rd " ..... 8/6 "
Weekly average: 3s.

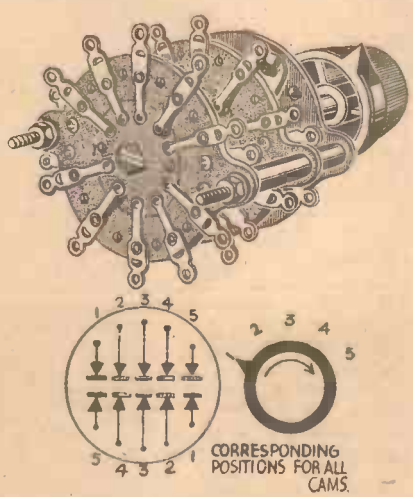
The cash price of the receiver is £17 17s.

Instruction Booklet

Full details of how to get the maximum results from the R.A.P. "Regent" All-Wave Superhet are contained in the attractive instruction booklet issued to every leaser. If the instructions set clearly forward in this booklet are strictly adhered to, any listener, however inexperienced, can tune in to any station in the world without the slightest difficulty.

Lease-a-Radio Depôts

The central depôt of Lease-a-Radio is at 117, Regent Street, W.1, and depôts are also situated at Kensington, Streatham, Richmond, Bromley, Wembley, Finchley, and Ilford. There is also a depôt at Colchester, and others are opening elsewhere shortly.



The B.T.S. multi-contact switch, showing the method of cross connection in pairs.

B.T.S. Multi-pole Switch

THE problem of switching two or more circuits has always confronted the designer of switch-gear, and many novel attempts have been seen since the days of multi-circuit tuners. Certain designs have produced favourable results in one direction, but have had some drawback in another. It should be borne in mind that apart from reliability one of the essentials of a multi-pole switch is silence of operation, and this desirable feature cannot always be obtained. Where it exists in a new switch, it is often found that, after repeated use, noises arise due to wear of the contacts, or to particles of metallic dust between the contacts. Therefore, when choosing a switch some care should be taken, and the new B.T.S. model, a two-unit version of which is seen on this page, will be found to possess all the desirable features in a switch, without any of the undesirable points.

A circle of insulating material carries ten separate contacts, arranged five on either side, and the centre of the disc is cut out and a further movable disc inserted. This has a narrow slot into which the operating spindle (which is flat) fits. A small metallic inset on this rotating disc engages with the surrounding contacts, and a circular disc of metal engages with the rotating contact and in turn is connected to an additional soldering connection on the outer edge of the disc. It will be seen, therefore, that as the operating spindle is turned, the contact will move from one point to another, and an end plate on the assembly is provided with recesses into which a roller sinks and gives a definite location at each point. By doubling the contacts on each section the switch operates as a single-pole-change-over control and opposite pairs of contacts are connected in turn, as shown by the small inset drawing. Any number of these units may be mounted on a single control and thus the most intricate circuit switching may be easily carried out.

The price of the two-unit switch shown, known as a two bank, two pole, 5-way switch, is 5s. 9d.

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).

Receiving S.W. Distant Stations

SIR,—Please allow me to thank you for the short-wave articles which appear in PRACTICAL AND AMATEUR WIRELESS, and also for other features which are excellent. I once owned an adapter which, however, did not get any distant stations, so I bought a Discovery S.G.3, which you reviewed some time ago. Now, on looking through your paper I find that readers are receiving long logs, using an adapter-converter or 0.v.1, 0.v.2, or other small set. I have got a dipole aerial, with a short earth to a water pipe, and also am using a wet H.T. 120v. My house is on a good hill, but U.S.A., S.M., B.A., and also Australia come in with only a whisper on a pair of 2,000-ohm earphones. But Japan, SPW, RW59, 2RO, DJD, EAQ, HBL, TPA, and GSB and other European stations come in very well. I have received a QSL from EAQ recently, and it is my first one. I received VK3LR a few weeks ago, so last Sunday I decided to try Sydney VK2ME. I tuned in at 07.30 G.S.T. and heard the station faintly. I would be very pleased to get in touch with a short-wave listener in my district with a view to our mutual listening and logging benefit—A. S. CONNOR (Blackheath).

S.W. Correspondents Wanted

SIR,—I shall be very pleased to get in touch with anyone interested in the short waves; I will answer every letter received.—J. PATRICK (18, May Place, Meir, Stoke-on-Trent).

SIR,—I shall be glad to get in touch with a short-wave listener and constructor in my district.—R. HILL (271, Bexley Road, North Heath, Erith, Kent).

Good Reception on Our Single-valve Short-waver

SIR,—I am enclosing my log of short-wave stations which I have obtained on the simple one-valve set described in your issue of March 21st last:

America: W3XAL, W8XK, W9P, Europe: CT1CT, DJA, DJB, DJD, DJN, DJO, DJ9, EA9, GSB, GSO, HAS3, HBL, LKJ1, ORK, RK1, RW59, TFJ, TPA3, 2RO.

I picked up a most thrilling broadcast on May 8th from the airship *Hindenburg*, when over the Atlantic on her maiden voyage. In the "hookup" DJO, W9P, and the *Bremen* all spoke. The set is most certainly an excellent receiver—all thanks to PRACTICAL AND AMATEUR WIRELESS.—A. P. L. CASLING (Hale, Cheshire).

An Excellent Log from Bristol

SIR,—I read with interest the letter and log of Mr. E. I. Hobbs, of Oxford, in your issue dated May 30th. I enclose a log during a fortnight of evening listening, thinking it might interest other readers. The log includes forty-seven different English amateurs, twelve French, seven Irish, EA3CV, EA4BM, EA7AI (Spain), ON4VC, ON4NDB (Belgium), PA0DK (Holland), CT1AY (Portugal), I1TKM (Italy), CO6OM (Cuba), VO1I (Newfoundland), SM6WL (Sweden), LA1G (Norway), and the following American amateurs: W2AIK, W3EOZ, W1EDO, W2ELO, W3CUB, W2BSD, W1GCE. In addition I logged the following broadcasts, HBN, EAQ, 2RO, DJN, CT1AA, COCO, LKJ1, RKI, and W2XAF. My receiver is a conventional 0.v.2, which is adaptable to short, medium, and long waves. I might add that I use no "doublet," directional, transposed, or any other special aerial. All the above stations were brought in on a "crow's nest" aerial with a 15ft. down lead. Wishing your paper all the success and popularity it deserves.—R. GILBERT (Bristol).

Good S.W. Reception at Liverpool

SIR,—As I have not yet seen a log from this district published in your pages I enclose my own. My receiver is of the 0-v-2 type without band-spreading. I use an aerial 10 ft. high and 35 ft. long, and am unfortunate in having to use a 30 ft. earth lead.

Commercial stations:—W1XAL, W8XK, W2XAF, W2XAD, EAQ, RNE, RK1?, ETA, ETB, FYA, HBJ, JVM, and CO9GC.

Amateur stations on 20 metres:—W2ADJ, W2CBO, W2BSD, W5AC, W9BBU. W2EOO, W1GIC, W1FMW, W1PA, W2CWC, W1KJ, W3EOC, VE1CD, VE1DR, LA1G.

On 40 metres:—ON4BR, ON4MC, F8IM, F8OK, F8DM, F3IV, EA5BE, EI8G, EI8J, EI2J, PA0JL, and ON4VC.—D. W. NEILL (Gt. Crosby, Liverpool).

Transmissions from the *Queen Mary*

SIR,—I notice in the "Letters from Readers" page in your issue of the 23rd ult. a request for the *Queen Mary's* wavelength.

I picked her signals up at 00.15 on Friday, May 29th, when she was evidently giving a dance programme for American listeners with the American announcer supported by Mr. Jno. Watt as M.C., and, estimating by Rome on 31 metres, I should say the *Queen Mary* was operating on a wavelength of about 40 metres. Signals were exceedingly good on the L.S. and there was no fading or atmospherics using 12-18s. tuned copper wire as aerial. The set used was an 0-v-2, with open circuit aerial coil, tapped by means of a crocodile clip. Regenerative and capacity reaction were employed.—J. W. THOMPSON (Wirral, Cheshire).

SIR,—It may be of interest to some readers to know that I received station GBTT (*Queen Mary*) at 11.30 p.m. on the evening of May 28th.

At first I heard a London station calling them so I tuned further down the dial to 30.4 metres (approx.) and was just in time to hear Henry Hall call New York, and announce the theme song for the *Queen Mary*. It was "Somewhere at Sea," followed by Miss Eve Becke singing "I fell in love for the last time." Then Larry Adler playing "You Hit the Spot."

The time was given out as 9.35 p.m.

My receiver is a 2v. S.W. set built from a circuit diagram published in PRACTICAL AND AMATEUR WIRELESS, dated June 15th, 1935.

Signals came through at R6 on the loud speaker and without fading.—R. FRANKLIN (Leyton).

From Across the Border

SIR,—I enclose extracts from my log compiled during the last eight or nine months on short waves. My receivers have been an 0-v-1, an 0-v-0 and lately an 0-v-2. Most of the stations were heard on the 0-v-0. The total number heard is 595.

Two hundred and twenty G stations, including a "mystery" station G2M, were heard on 20 metres a few days ago.

About 60 French, Dutch, Spanish, Portuguese and Belgian amateurs—mostly on 40 metres, except for a few Spanish on 20 metres. I1KT and I1TKM on 20 metres. Also on 20 metres America has come over well. To date, I have received approximately 212 stations, including W2BSD. Canadians heard are VE1-AW, -BO, -CN, -DC, -EW, -WR; VE2-AM, -BG; VE3-BM, -EO, -GM, -JB, -KE; VE4JV. Cubans: CO2HY, CO2SD, CO6OM. Dominions: HI1X, HI5X—VP6YB Uruguay? Egyptians: SU1CH, SU1RO? Miscellaneous: NYZAE, VO1I, VO1J, OE1FX, CX1AA, LA1G, SMDY, and OZ1NW.

Concerning American 'phones I have not received a W1- yet. I have heard W7ONT several times, and W5-CF, DUK and HX come in well at times, usually round about 23.00-24.00 G.M.T.

On broadcast bands I have received all the usual stations, the total being 57, with 7 "HJ's," VP3MR, and VK2ME among them.

On commercial bands I hear Rugby frequently, also WOO and WQV. Recently I heard the *Queen Mary*, GBTT, on approx. 23 metres, and also the *Berengaria* GBZW testing. I was fortunate enough to hear the French PTT's broadcast from the *Queen Mary* through her own transmitter. I hope these details will be of interest to readers, and I would be very glad to correspond with anyone of my own age (16 years) interested in wireless, preferably in this district.—A. S. DRYBROUGH (Musselburgh, Midlothian).

CUT THIS OUT EACH WEEK.

Do you know

—THAT an ordinary milliammeter may be used for visual tuning indication.
—THAT a band-pass tuning circuit need not necessarily be inserted in the aerial circuit.
—THAT when an H.F. stage is employed the band-pass circuit may be used in the detector grid circuit.
—THAT a simple microphone circuit can consist of a microphone and headphones, without the use of a valve amplifier.
—THAT two loud-speakers may be used with speech coils in parallel to improve upon the reproduction of one single speaker.
—THAT when carrying out the above idea the output load must, of course, be accurately obtained.
—THAT a small indoor aerial should not be employed with a powerful receiver employing A.V.C., in view of the risk of background noises rising to a high level.

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

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

REPLIES IN BRIEF

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

R. S. (Reading). We regret that we are not familiar with the servicing difficulties of commercial receivers and therefore suggest that you communicate direct with the suppliers of your set or a local service agent.

R. C. (Daventry). It would appear from your brief remarks that the ganging of the circuits is not accurately carried out. Re-trim, and if you find that a modification is required on different stations it will indicate that the coils are not matched and they should be returned to the makers.

J. D. H. (Hawick). A standard four-pin coil could be used in the receiver in question and the standard connections should be employed. These are shown on page 205 of our issue dated May 9th last.

N. D. W. (Kandy, Ceylon). It is not possible to give any definite indication of the range of a receiver in view of the peculiarities of local conditions, etc. Furthermore, we have no details of the conditions in your district, but a local radio man may be able to give you some idea what can be expected from a receiver employing the circuit used in the set in question.

H. K. (Bexleyheath). The trouble is not due to the coil but to the fact that the amateur is probably situated quite close to you. We have no information regarding this particular amateur and therefore regret that we cannot help you.

F. G. B. (Lym). The receiver can only be ganged when matched coils are used. Are you using this type of coil? If all stations are heard at two settings it would indicate that the circuits are not matched.

A. W. N. (Buckingham). The speaker should handle the volume if it was fitted by the makers and therefore we suspect a fault. It would be advisable to have the speaker and receiver tested by a service engineer of the company, or send the speaker to the makers for test. If you force reaction too far you would get distorted signals, and this may lead you to suppose that the speaker is not handling the full volume.

P. C. (Greenock). We regret that we have no technical data of the chokes in question.

D. McM. (Eastbourne). The trouble may be due to instability set up by the position of the connecting wires on the H.F. side of the receiver or to an unsuitable H.F. choke. Short-circuit the choke and see if the oscillation ceases. If so, change the choke or modify its position.

L. W. J. L. (Sidmouth). The aerial scheme in your sketch would be better than a frame aerial, and we would not recommend the change mentioned by you.

A. W. H. (Sheffield). If the dial is novel it could be patented, and a provisional specification may be obtained at a cost of £1 and gives protection for nine months. It would pay you to obtain the services of a good patent agent who would see to the best method of formulating the claims. The specification could then be forwarded to various firms with a view to getting some manufacturer to take up the idea. We cannot understand anyone making up an instrument as you suggest without first ascertaining its use, and in practically all of our articles we explain the use of the apparatus either before or after the actual construction.

G. T. (Walsall). We have no circuit details of the receiver, and suggest that you communicate direct with the makers, who may be able to assist you.

W. H. (Bargoed). Blueprint W.M.392 should be of most use to you.

K. G. F. (Layton). Your query is not clear. To what receiver do you refer?

H. S. (Wordsley). The price of the receivers would vary according to the components you employed. The set alone should only cost about 10s. to 15s., but headphones would cost as much.

N. N. (S.W.4). We have not yet designed a receiver to meet with your requirements. The £4 Superhet could be employed in conjunction with a short-wave converter for the purpose.

R. A. L. (Bristol). The only book we can suggest is the Television and Short-Wave Handbook, but this does not include details of apparatus to receive the latest high-definition television programmes.

J. W. A. (Leeds). An ordinary potentiometer could be used, and could be obtained, together with the crystal, from Electradix Radios of Upper Thames Street, E.C.

F. W. P. (Abthorpe). You could convert the receiver to employ standard 4- or 6-pin plug-in coils and the connections for these will be supplied by the makers, or may be ascertained from the article on page 205 of our issue dated May 9th last.

M. C. (Tallaght). We regret that we have no data of the coil referred to. The makers produced several dual-range coils, and methods of connecting, as well as the terminal arrangements, differed. We have no data here now and the firm in question no longer makes radio parts.

C. S. (Abram). We regret that we are not familiar with the servicing difficulties of commercial receivers, and suggest that you communicate with the English agents of the makers of your receiver. Their address is Majestic Radio, Majestic Works, Tariff Road, Tottenham, N.17.

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.

CARDIFF AND DISTRICT SHORT-WAVE CLUB

AT the last meeting of the above club arrangements were made for a lecture to be given by Mr. W. Sutton on June 11 on the subject of "Receiver Construction," and it was also decided that morse practices, which were so successfully held a few months ago, should be continued, as there was a definite need for them in the area at the moment. Readers of PRACTICAL AND AMATEUR WIRELESS, who are interested in short-wave activities are cordially invited to attend any of the meetings, which will be held on the following dates:—

June 11th, 1936; June 16th, 1936; June 25th, 1936; July 2nd, 1936; July 9th, 1936; and July 16th, 1936.

The secretary, Mr. H. H. Phillips, of 132, Clare Road, Cardiff, will be pleased to give any information regarding the club and its activities.

CATALOGUES RECEIVED

K.B. RADIO

FOUR new K.B. receivers are listed in the latest folder issued by Kolster-Brandes, Ltd. They are identical in appearance, and, with slight exceptions, their general specification is similar. It includes an H.F. Pentode, detector, output pentode, and, in mains models, an A.C. rectifier; loose-coupled aerial circuit and highly efficient H.F. transformer-coupling, employing high "Q" coils: single slow-motion tuning control with wave change switch combined; large open full-vision dial with station names and metres (illuminated); automatic wave-range indicator; reaction control and combined volume control and "on-and-off" switch. The new models, K.B.510 and 515, are designed for A.C. supplies, while the K.B.520 is a universal receiver. Model 530 is a 3-valve battery receiver suitable for medium and long waves, and is priced at 7½ guineas. The other three models are priced at 8½, 9½, and 8½ guineas respectively.

Practical and Amateur Wireless
BLUEPRINT SERVICE

These blueprints are full size. Copies of appropriate issues containing descriptions of these sets can in most cases be obtained as follows:—"Practical Wireless" at 4d., "Amateur Wireless" at 4d., "Practical Mechanics" at 7½d., and "Wireless Magazine" at 1/3d., post paid. Index letters "P.W." refer to "Practical Wireless" sets, "P.M." to "Practical Mechanics" sets, "A.W." refer to "Amateur Wireless" sets, and "W.M." to "Wireless Magazine" sets. Send (preferably) a postal order (stamps over sixpence unacceptable) to "Practical and Amateur Wireless" Blueprint Dept., Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

PRACTICAL WIRELESS

STRAIGHT SETS. Battery Operated.

	Date of Issue.	No. of Blueprint
One-valve : Blueprints, 1s. each.		
All-Wave Unipen (pentode)	—	PW31A
Two-valve : Blueprints, 1s. each.		
Four-range Super Mag Two (D, Pen)	11.8.34	PW36B
Three-valve : Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (trans.))	—	PW10
Sixty-Shilling Three (D, 2 LF (R.C. & trans.))	2.12.33	PW34A
Leader Three (SG, D, Pow.)	—	PW35
Summit Three (HF Pen, D, Pen)	18.8.34	PW37
All-Pentode Three (HF Pen, D (pen.), Pen)	22.9.34	PW39
Hall-Mark Three (SG, D, Pow.)	—	PW41
Hall-Mark Cadet (D, L.F. Pen (R.C.))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (pen), Pen) (All-Wave Three)	13.4.35	PW49
Genet Midget (D, 2 LF (trans.))	*June* '35	PM2
Cameo Midget Three (D, 2 LF (trans.))	8.6.35	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	17.8.35	PW53
Battery All-Wave Three (D, 2 LF (R.C.))	31.8.35	PW55
The Monitor (HF Pen, D, Pen)	8.2.36	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	7.12.35	PW64
Four-valve : Blueprints, 1s. each.		
Fury Four (2 SG, D, Pen)	—	PW11
Beta Universal Four (SG, D, LF, Cl. B)	15.4.33	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	6.1.34	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's Superformer (SG, SG, D, Pen.)	12.10.35	PW57

Mains Operated.

Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Power)	7.10.33	PW31
Selectone A.C. Radiogram Two (D, Pow.)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, D.D.T., Pen)	10.6.33	PW23
D.C. Ace (SG, D, Pen)	15.7.33	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Power)	7.4.34	PW35C
D.C. Premior (HF, Pen, D, Pen)	31.3.34	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	18.8.34	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"Allwave" A.C. Three (D, 2LF (R.C.))	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	31.8.35	PW56
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	9.2.35	PW47

SUPERHETS

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

SHORT-WAVE SETS.

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

PORTABLES.

Three-valve : Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable.	16.5.36	PW65
Four-valve : Blueprints, 1s. each.		
Featherweight Portable Four (SG, D., LF., Cl. B)	—	PW12

MISCELLANEOUS.

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

AMATEUR WIRELESS AND WIRELESS MAGAZINE

CRYSTAL SETS.

Blueprints, 6d. each.		
Four-station Crystal Set	—	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450

STRAIGHT SETS. Battery Operated.

One-valve : Blueprints, 1s. each.		
B.B.C. Special One-valver	—	AW387
Twenty-station Loud-speaker One-valver (Class B)	—	AW449
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D. Trans.)	—	AW388
Full-volume Two (SG, Det., Pen)	—	AW392
Iron-core Two (D. Trans)	—	AW395
Iron-core Two (D. Q.P.P.)	12.8.33	AW396
B.B.C. National Two with Lucerne Coil (D. Trans.)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans)	—	AW338A
Lucerne Minor (D, Pen)	—	AW426
Three-valve : Blueprints 1s. each.		
Class-B Three (D, Trans, Class B)	22.4.33	AW386
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394
Home-Built Coil Three (SG, D, Trans)	—	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher: Chassis Model (SG, D, Pen)	—	AW419
Lucerne Ranger (SG, D, Trans)	—	AW422
Cossor Melody Maker with Lucerne Coils	—	AW423
P.W.H. Mascot with Lucerne Coils (D, RC, Trans)	—	AW337A
Mullard Master Three with Lucerne Coils	—	AW424
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All Britain Three (HF Pen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.11.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
£6 6s. Radiogram (D, RC, Trans)	—	WM318
Simple tune Three (SG, D, Pen)	*June* '33	WM327
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
Graduating to a Low-frequency Stage (D, 2LF)	—	WM378
P.T.P. Three (Pen, D, Pen)	*June* '35	WM389
Certainty Three (SG, D, Pen)	*Sept.* '35	WM393
Minitube Three (SG, D, Trans)	*Oct.* '35	WM396
All-wave Winning Three (SG, D, Pen)	*Dec.* '35	WM400
Four-valve : Blueprints, 1s. 6d. each.		
65/- Four (SG, D, RC, Trans)	—	AW370
"A.W." Ideal four (2SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2SG, D. Pen)	—	AW421
Crusaders' A.V.C. 4 (2HF D, QP21)	18.8.34	AW445
(Pentode and Class-B Outputs for above: blueprints 6d. each)	25.8.34	AW445A
Self-contained Four (SG, D, LF, Class B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2LF)	*Feb.* '35	WM381
The H.K. Four	*Mar.* '35	WM384
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2HF, D, RC, Trans)	*May* '33	WM320
New Class-B Five (2SG, D, LF, Class B)	*Nov.* '33	WM340
Class-B Quadradyne (2SG, D, LF, Class B)	*Dec.* '33	WM344
1935 Super Five (Battery Superhet)	—	WM379

Mains Operated.

Two-valve : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	23.9.33	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C./D.C. Two (D, Pen)	*Sept.* '35	WM304
Three-valve : Blueprints, 1s. each.		
Home-lover's New All-electric Three (SG, D. Trans) A.C.	—	AW383
S.G. Three (SG, D, Pen) A.C.	—	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF, Pen, D, Pen) A.C.	23.6.34	AW439
Mantovani A.C. Three (HF, Pen, D, Pen) A.C.	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	*Jan.* 36	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen)	*July* '33	WM329
Harris Jubilee Radiogram	*May* '35	WM386

SUPERHETS.

Battery Sets : Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM371
Varsity Four	*Oct.* '35	WM395
Mains Sets : Blueprints, 1s. 6d. each.		
1934 A.C. Century Super A.C.	10.3.34	AW425
Heptode Super Three A.C.	*May* '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
1935 A.C. Stenode	*Apl.* '35	WM385

PORTABLES.

Four-valve : Blueprints, 1s. 6d. each.		
Midget Class-B Portable (SG, D, LF, Class B)	20.5.33	AW638
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM363
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM367

SHORT-WAVERS—Battery Operated.

One-valve : Blueprints, 1s. each.		
S.W. One-valve converter (price 6d.)	—	AW329
S.W. One-valve for America	—	AW429
Roma Short-waver	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-short Battery Two (SG det, Pen)	*Feb.* '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-waver	*Jan.* 19, '35	AW403
The Carrier Short-waver	*July* '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World Beater (HF Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valve Short-waver	*Mar.* '35	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-wave Super	*Nov.* '35	WM397

Mains Operated.

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

MISCELLANEOUS.

Enthusiast's Power Amplifier (1/6)	*June* '35	WM387
Listener's 5-watt A.C. Amplifier (1/6)	*Sept.* '35	WM392
Radio Unit (2v.) for WM392 (1s.)	*Nov.* '35	WM398
Harris Electrogram (battery amplifier)	*Dec.* '35	WM390
De-Luxe Concert A.C. Electrogram	*Mar.* '36	WM403
New style Short-wave Adapter (1s.)	*June* '35	WM388
Trickle Charger (6d.)	*Jan.* 5, '35	AW462
Short-wave Adapter	*Dec.* 1, '34	AW456
Superhet Converter	*Dec.* 1, '34	AW457

QUERIES and ENQUIRIES

Converting a Meter

"I have a well-known make of milliammeter of the moving-coil variety reading from 0 to 20 milliamps. I wish to convert this to read from 0 to 5 milliamps for the purpose of visual tuning. I do not want to go to the expense of buying a new meter. If it cannot be converted, I have a number of old voltmeters which I believe can be converted. Your help in this matter will be very welcome."—G. S. U. (Tottenham, N.).

YOUR present meter requires that a current of 20 mA be passed in order to carry the needle to the end of the scale, and therefore if only 5 mA is passed through the instrument the needle will only travel over part of the scale. You presumably wish to convert the instrument so that at this low current the needle will travel to the end of the scale and therefore some resistance must be removed from the instrument. Some makes of meter are built so that only 1 mA or so carries the needle over the entire scale and then a resistance is included inside the instrument to multiply or increase the scale, and if your instrument is of this type you could remove the resistance if you can locate it inside the case. We do not advise this modification, however, in view of the possibility of damaging the instrument, and it should be taken as a general rule that the reading on a meter cannot be modified in the direction indicated, although it may easily be increased by the addition of external resistances. Your voltmeters are no doubt of the low-resistance type in which the full scale deflection is of the order of 20 mA or more, and thus the same remarks apply. If, however, you have a meter with a resistance of 1,000 ohms per volt, and which reads up to only 5 volts, this could be employed exactly as it stands for your purpose by including it in series in the circuit you are using.

Push-pull Parallel

"The enclosed diagram is the output circuit of the Universal Hall-Mark Four, but with my own addition of two more pentode valves in parallel with the output valves. I would be glad if you would advise me if the arrangement will prove satisfactory, or whether the circuit will require any further alteration. I may say that I am only using the detector and output part of the set for gramophone reproduction, so that the addition of two more valves in the filament circuit will only mean a smaller dropping resistance. If the arrangement is practicable, what would be the output?"—F. H. M. (Liverpool, N.23).

THE output valves which are fitted are designed for a grid swing of 20 volts each, and thus the normal push-pull stage requires a signal voltage of 40 volts fully to load it. The input transformer has a ratio of 1 to 9, and thus the preceding stage must produce a signal voltage of just over 4 volts, and as this valve is only to be used by you in conjunction with a pick-up, it is doubtful whether you will exceed this voltage. Thus there is no necessity for the additional valves in parallel with the output valves. The effect of doing this would be to increase the handling capacity of the output stage two-fold, and thus twice the signal voltage could be dealt with in order to deliver double the output. To take full advantage of your modification, therefore, you would need a further L.F. stage so as to fully load the output stage. The impedance of the output stage will be halved when the additional valves are added and thus the speaker will have to be rematched.

Waveform Coils

"Can you give me rough details of a machine required for winding the narrow wave-form coils of, say, ¼in. wide and ½in. deep."—W. H. (Alnmouth).

IF you only require a few of these coils it would not be worth while making up a complicated winding machine such as is used commercially for the production of this type of coil. The old scheme which was popular in the early days of broadcasting could be adopted in such a case. A former of wood to suit the inside diameter of the required coils is needed and two circles are marked round the former equal to the width which is required in the finished coil. An odd number of pins is then driven into the circles to form two rows of spacers, and the wire is passed round one pin across to a pin on the other ring, back round a pin in the first ring, and so on. Thin wire will have to be used for the type of coil you mention, and when the required number of turns has been wound the coil should be shellacked or doped with some similar material, and when dry the pins should be removed. The coil may then be slipped off the former and will remain rigid. Various waveforms may be employed by adopting varying numbers of pins in each row and by modifying the number of pins which are missed at each cross-over.

RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters.

We regret that we cannot, for obvious reasons—

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

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

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

S.W. Converter

"Would you kindly advise regarding a converter or adapter for the short waves to be used with my Cossor receiver. If you have a blueprint to suit my requirements, would you recommend the price and type?"—H. W. (North Shields).

THE receiver you are now using could be employed with either the adapter or converter, the latter providing the best combination. The only difficulty is to be found in the fact that if the commercial receiver is a superhet, some trouble may be experienced due to whistles arising from the fact that double frequency changing will take place. Furthermore, the receiver, if of the superhet type, may be fitted with some whistle interference eliminator in the aerial circuit which will prevent the satisfactory function of the converter. You should therefore ascertain from the makers of the set whether or not it is suitable for use with a converter, and if so, blueprint PW.48A will meet your requirements. This unit may also be employed as an adapter in conjunction with the detector stage of your receiver in the event of the converter proving unsuitable.

Choosing a Set

"I should like to construct a radiogram with excellent tone. Foreigners and short waves would be welcome, but, as just mentioned, I should like nothing sacrificed to purity of reproduction. I imagine that these days 'all mains' win the day on all circuits, but if there are any advantages with a battery set, perhaps that may weigh in the balance. Four or five valves should be sufficient, I hope. Perhaps if less will achieve the same result, a smaller set can be used. I require purity of tone, cheapness, all mains (if practicable), four or five valves, and selectivity and short waves."—E. E. H. (New Malden).

WE have not designed a receiver on the lines mentioned by you and have no quality receiver which can be used also for short-wave reception. To keep within the remainder of your suggestions, the Hall-Mark Four could be suggested, and this may be obtained for battery, A.C., or D.C. mains operation. The cheapest model is obviously the battery set, but for best results from the point of view of quality and range we suggest the Universal model, which may be used on either A.C. or D.C. mains without modification. To use the receiver for short waves you could connect a converter to it, and the unit which is described on blueprint PW.48A will be found quite suitable either for the battery or mains receiver, as it may be operated from either source.

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

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face 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. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," 8, Southampton Street, Strand, London.

RADIO CLEARANCE

63, HIGH HOLBORN, W.C.1

TEL.: HOLBORN 4631.

END OF SEASON SALE
SUPER BARGAINS FOR ALL

52/- **LISSEN SCREEN GRID, DETECTOR, PENTODE SET.** Handsome Ebony finish cabinet, Chromium fittings, Moving Coil Speaker. Complete with Valves, BRAND NEW.

67/6 **BUSH 3 VALVE BATTERY SUPERHET.** Modern cabinet, Moving Coil Speaker, Multi Valves, A.V.C., etc.

5/6 **TRIAD VALVES.** 01-A, 24A, 27, 30, 31, 32, 33, 35, 37, 38, 39, 41, 42, 43, 45, 46, 47, 53, 55, 56, 57, 58, 59, 71A, 75, 78, 80, 6A6, 1C6, 6F7, 2A3, 5Z3, 12A7, 6A6, 6A7, 6D6, 12Z3, 25Z5.

3/6 **SPECIAL OFFER AMERICAN VALVES,** type 12Z3, 5Z3, 25Z5, 6B7, 6A7, 6FY, 45.

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

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

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

BRYCE MAINS TRANSFORMERS.

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