PRACTICAL WIRELESS, September, 1941.

WAR-TIME "HOOPO-UPS"—SEE PAGE 359

A NEWNES PUBLICATION

Edited by F.J. CAMM
Vol. 17. No. 423.

EVERY MONTH
September, 1941.

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Broadcast Propaganda Again

CRITICISM continues to be levelled at the B.B.C. for its failure to put energy and ideas into the propaganda intended for consumption abroad. The critics point, perhaps with some justification, to the American style of broadcast, as well as to the Russian, and it is said that the B.B.C. is not a good expert propagandist to the microphone in the form of journalists whose lives have been spent in moulding public opinion. The B.B.C., no doubt, has its answer to this criticism, but a point often overlooked is that America and Russia are countries whose national temperaments are some what different from ours. We are credited with being insular and phlegmatic as a race, and whilst the B.B.C. style of broadcast propaganda may be correct for home consumption, it does not tickle the palates of foreign listeners.

The B.B.C., however, cannot be held to blame for the war, only it may only read out such information as it is permitted to do by the Ministry of Information, and it is in this direction that improvement is needed. The Ministry of Information has not covered itself with glory on some of the occasions where it should have risen. Members of Parliament have asked frequently that the Ministry of Information should use its imagination, and this suggestion in common with the House of Commons evidently merely elicits the riposte from Winston Churchill that there are certain things which stagger the imagination.

American Comment

THE matter has been raised again since the famous broadcast of Quentin Reynolds, the American newspaper correspondent. We have received many letters of approval of this style of broadcast talk, and it might be worth a try over here. There is another matter connected with propaganda which needs to be aired. Propaganda does not consist of warping the truth or inventing half-truths, nor in being careless with the truth in order to avoid opinion abroad. A simple statement of fact has its own propaganda value, and to endeavour to do it up or to give it no importance out of proportion to its incidence to the war is not only to destroy its propaganda value but to destroy the very belief in future statements made over the air. Truth must, therefore, be the first aim of our foreign propaganda. And we do not support the views generally held that we need to indulge in ballyhoo. We want our propaganda taken seriously, for any suggestion that it has been touched up, or any attempt made to render it humorous, would destroy it as propaganda. Unfortunately, the word propaganda has taken on a different meaning in the last few years. Publicity experts use the term to describe any method that the opposing side to "put it over"—an objectionable phrase savouring of the pulling of an unworthy article.

The point we make is that whatever methods and phrases are not blame the B.B.C. for it. If it evolves its own plans they are doubtless sat upon by the Ministry of Information. Words do not win wars, and as far as one can trace up to the present, none of the broadcast propaganda has had the slightest effect upon the peoples of other nations. The interesting and certainly entertaining broadcast talk of Quentin Reynolds tickled our palates for the time being, but we do not believe that it will be repeated. The B.B.C., no doubt, has its answer to this. Perhaps with some justification, to the Door! It is soon, however, forgotten, and Germany gets on with the war.}

V for Victory

WE do not attach a great deal of importance to what was announced from the B.B.C. as our new weapon. Apparently the people of the vanquished countries are being encouraged to chalk the letter "V" on walls, and some wag has discovered that the first letters of Beethoven's Fifth Symphony (reminiscent of Fate Knocking at the Door!) is really the Morse equivalent of the letter V. Now this is entertaining, but we fail to see where it is a weapon of war, nor are we able to discern what possible effect it can have upon the Germans. It may annoy them in much the same way as we are annoyed when small boys chalk rude words on garden gates. We hope that it will inspire them to revolt against their leaders. Germans are occupying the countries, and it may be that it will inspire the vanquished peoples and rouse them up in the hope that we shall release them from their bondage. If this is the case, it was remiss of this country not to have inspired them before they were overrun. The effort should have been designed to make them resist instead of, as in most cases, to have been passively overruled.

Patents In War-time

THE war has naturally stimulated the production of inventions relating to the war, but has been followed by a revival of interest in inventions relating to articles of public consumption which have come into special demand owing to war conditions or modifications of such articles to meet the new conditions.

The various Government departments are taking an interest in such inventions and they have a special organisation for dealing with inventions. This we believe applies to the Ministry of Aircraft Production, the War Office and the Ministry of Supply. These departments appear to take note of any patent applications filed which from their title appear to have some special interest to the department. When this is the case a formal letter is sent to the applicant, either direct or through his Patent Agent, asking the applicant to submit to the department a copy of his specification together with any particular explanation of the invention which would enable the department to consider whether it could be used in the National War Effort.

The Government departments have power to prohibit the publication of the particulars of any invention which they consider might be of benefit to the enemy if it should come to their notice. The departments also have the right to take over and use an invention, and they may in some circumstances arrange for the patent to be made over to the department for the benefit, and are not actually obliged by law to make any payment in respect of such an invention. In practice, however, the amount of payment which an invention has admittedly been used by them. If they are unable to agree with the inventor with regard to the amount of the payment then this may in some circumstances be settled by arbitration.
A Novel Receiver Control

A Method Using a Midget Receiver to Operate a Large Receiver.

The following is a description of a system of remote control developed by the Radio Corporation of America in which a midget or other portable receiver is used to control another receiver, preferably one having a large output and employing a well-designed internal or extension speaker. The main idea of the scheme is to use an L.F. stage, preferably the output stage, as an H.F. oscillator which is modulated by the midget receiver signal. The radio-frequency oscillations are picked up by the large receiver and reproduced by the latter. The volume control of the midget receiver controls the gain of the signals reproduced by the main receiver.

Output Circuit

Figure 1 shows a method of wiring the output circuit of a midget receiver for this purpose. The tuner, frequency converter, L.F. amplifier, a second detector, volume control and audio-frequency amplifier of the receiver are assumed to be quite normal, and are, therefore, shown in block schematic form. The output valve, which is of the beam valve type, is connected to the first L.F. stage by means of the usual grid leak and coupling condenser. The cathode is connected to a switch which either switches in an un-bypassed cathode resistor for use with the receiver under normal conditions or, alternatively, a larger by-passed resistor for the purpose of reducing the current taken by the output valve when operating as an oscillator.

A further switch, gauged to the previous one, is located in the anode circuit, and serves to disconnect the speaker transformer primary winding, and to connect in circuit the reaction winding, which is coupled to the oscillator tuned circuit connected to the screen-grid of the output valve. This tuned circuit is adjusted to a suitable frequency, such as at the low-frequency end of the medium-wave broadcast band, i.e., about 550 kc/s. A further tuned circuit is coupled to the oscillatory tuned circuit by means of a choke-controlled modulator, using the speaker transformer primary winding as the modulation transformer or choke. In addition, gramophone pick-up terminals may be connected to the midget receiver for use with either a pick-up or a microphone.

While the remote control system will operate satisfactorily in many installations merely by the radiation from the power line being picked up by the normal aerial of the remotely controlled receiver, it has been found that best operation may be obtained if the input circuit of the remotely controlled receiver is coupled to the power line.

Filter Device

For this reason an aerial selecting and filter device 92 (see Fig. 2) is provided for in one lead of the power supply circuit and a by-pass condenser 98 across the output end of the filter. The terminals 99 of the filter are arranged to receive a plug-in connection 100 for the power cord 96 of the receiver. The leads 94 are provided with a plug 101 for the usual power outlet or baseboard power supply connection. The aerial and earth connections on the receiver 111, indicated respectively at 102 and 103, are connected through leads 104 with terminals 105 of the unit 92 which in turn are connected with the switch arms 106 and 107 of a suitable aerial selector switch. In the position shown the contact arm 106 for the aerial connection engages a contact 108 connected with a terminal 109a for the aerial 110, while the arm 107 is connected with a contact 110a having a terminal connection 93a for the earth 93. This provides the normal aerial and earth connections for the receiver 111.

Operation of Filter

When the arm 106 is moved to a contact 112, the aerial is coupled through a condenser 113 with one side of the power line on the power line side of the filter choke 97. The switch arm 107 is connected to move jointly with the arm 106 to engage a contact 114 through which the earth connection of the receiver is completed with the opposite side of the power line through a coupling condenser 115. This selective switching arrangement permits the remote receiver 111 to be coupled with the power line to receive the modulated oscillations therefrom directly, while the rectifier system is insulated from the power supply line and the modulated oscillations by the filter 95. In practice, the unit 92 is supplied with the remote control receiver for use in connection with any radio receiver for which the receiver of Fig. 1 may act as a remote control unit.

As similar hum troubles arise in the midget receiver, in the circuit of Fig. 1, a filter consisting of a portion of the tapped heater element of the power rectifier and suitable capacities should be provided between the power circuit and the power rectifie, to prevent the rectifier from short-circuiting the power line with respect to radio-frequency signals or the modulated signals, whenever the rectifier conducts current. The oscillator coupling coil for the power line is connected to the line side of the filter thus provided.
Improved Loudspeaking Telephone

Radiator-type Loudspeaker having an Output of Twenty Watts

Many high-quality sound-producing systems have been constructed in recent years with various loudspeaker elements designed to cover a wide frequency range. For the most part these systems have utilised multiple devices in which two or more loudspeaker units have been used in combination, each component unit reproducing only a part of the frequency spectrum. Other systems have been constructed in which a single loudspeaker, plays the double role of reproducing lower frequencies through a horn connected to one side of the diaphragm, and higher frequencies directly from the opposite side. In some cases, a rather wide frequency range has been produced, and very satisfactory quality has been obtained.

Several factors associated with sound radiation and vibrating systems have necessitated multiple systems for reproducing wide frequency ranges. The more important of these are the low-frequency radiation requirements, which demand large amplitudes even when large radiating surfaces are used; the inertia of the vibrating system which results in a loss of efficiency at the higher frequencies; and the directivity of sound radiators at higher frequencies, which is a function of the size of the radiator or diaphragm.

Multiple units generally involve complications, both in the mechanical structure and in the associated circuits. These complications can be overcome by careful design, but the result is an instrument of relatively high cost. For some time a low-cost speaker of high quality, small size, and moderate power capacity has been needed.

Such instrument is required in broadcast monitoring rooms, and in reproducing systems for small rooms.

Direct Radiator Type

Low cost and small size are most readily obtained in a direct-radiator loudspeaker: that is, one whose diaphragm radiates sound directly into the air, and which does not require a horn. To obtain the high-quality performance desired with a single loudspeaker of the direct-radiator type, the diaphragm must be small enough so that it will not be too directive at the higher frequencies. At the same time the diaphragm must be capable of operating at the large amplitudes required for radiating the lower frequencies. In addition, the effective mass of the diaphragm must be small enough to radiate the higher frequencies efficiently. Even with very thin metal diaphragms, mass reaction is sufficient to cause excessive loss in the high-frequency range if the diaphragm operates as a piston: that is, if all parts of the diaphragm surface move in unison. This effect can be overcome by using a diaphragm in which all parts do not move in unison when operated at higher frequencies, and such a diaphragm will radiate uniformly at all frequencies if properly designed. The problem, then, becomes one of determining the proper diaphragm material, and shape, to provide the desired high-frequency performance, and at the same time to permit free piston vibration at low frequencies where large amplitudes must be provided for.

Thin metallic diaphragms offered the most favourable properties for such a development as far as the desired effects are concerned, but the problem of forming a diaphragm of this type, which would permit the necessary amplitudes at low frequencies, have the required high-frequency performance, and be free from rumbles and extraneous sounds, required considerable experimental work. The development of such a device, however, was finally successful in the Western Electric 715A loudspeaker. This instrument is a direct radiator with a formed metal diaphragm 8 ins. in diameter, which moves in a permanent magnet field. The loudspeaker is intended for mounting in a closed cabinet of the proper design and capacity; when furnished so mounted, the combination is known as the 715A loudspeaker. Any cabinet of suitable design, however, may be used.

Response-frequency Characteristic

A representative response-frequency characteristic of the loudspeaker when thus housed is shown by the solid curve in Fig. 3. The sound pressures measured on the axis are relatively uniform from about 60 to 11,000 cycles, a frequency range sufficient for high-quality reproduction. The sound output is somewhat less uniform in the upper frequency range than for some horn-type speakers, but it is adequate for good
reproduction. For comparative purposes, the response-frequency characteristic of the best commercial cone-type dynamic speaker which has come to our attention is shown in dotted line on the same drawing. Identical testing conditions were imposed in measuring the two speakers. One feature of the 750A loudspeaker, the effect of which is indicated on the response curve, is a simplification of mechanical damping which reduces the low-frequency resonance peak so as to eliminate so-called "hang-over" effects.

An inherent limitation in a device of this type, as compared with a more elaborate combination of horn-type speakers, is the inability to control the distribution of the radiated sound. As previously indicated, the reproduction from a speaker of this type is more and more deficient in the higher frequency range as the observer moves away from the axis of the speaker. The best quality is observed within a thirty-degree angle, but satisfactory performance over a wider angle is obtained for many purposes. The diminution of high-frequency radiation is not serious up to an angle of 45 degrees. In rectangular rooms of moderate size a single speaker usually suffices. For larger rooms, or rooms of considerable width, two or more speakers may be required for the best reproduction.

**Twenty Watts Output**

The efficiency of the new loudspeaker is equal to that of commercially available cone-dynamic speakers of the same size and weight. When reproducing speech or music it is capable of handling the maximum undistorted output of a 20-watt amplifier at single-frequency rating.

The 750A loudspeaker is not intended to replace existing multiple-unit systems, but rather to fill a long-felt need in situations where more elaborate devices are not required or may be prohibitive because of cost or size. In locations where high sound levels are not necessary, and where the angle of coverage is not too great, the instrument will reproduce speech and music with remarkable fidelity.—Bell Laboratories.

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**The British Institution of Radio Engineers**

The annual general meeting of the Institution was held on Saturday, June 28th, at the Federation of British Industries, London, S.W.1.

Giving the annual report of the council, Sir Arrol Moir, Bart., joint president, stated:

"In its responsibility for conducting the Institution's examinations, the committee now under the able chairmanship of Mr. W. B. Medland, B.Sc., a past president, has done valuable work in providing a means of recognising the ability of students and offering to employers means of securing qualified assistants. The terms of reference of the committee are: 'To formulate schemes for a national study in radio and allied engineering and to co-operate with the educational authorities in the arrangement of courses of instruction, to prepare schemes for and to hold examinations in radio and allied engineering, whether entitling successful candidates to membership of the Institution or otherwise, and to do all those things necessary for the carrying out of these terms of reference.'"

Sir Arrol Moir also submitted a proposal that a Professional Purposes Committee be established . . . with a view to investigating the progress made by the Institution in gaining independent professional status for the qualified radio and allied engineer. Such a committee would deal mainly with qualifications required for membership and classification of occupations coming within the orbit of our activities. This would assist general acceptance of the Institution's status and would provide for any revision necessary to the articles of association and the general activities of the Institution.

**North-western Section**

Referring to the inauguration of a North-western Section of the Institution and the formation of the British Institution of Radio Engineers and the Institute of Wireless Technology, he quoted a letter from Mr. James Nelson published in August, 1925. In this letter, Mr. Nelson referred to the foundation of a professional radio engineering body and stated: "It is intended that the society shall be called The British Institute of Radio Engineers..."

The report continued: "The Institutions Appointments Register, as distinct from the Central Register, has been kept in operation, although there have been but few members to submit to employers. Naturally, war needs take priority, but active service and Government appointments have created a large number of 'duration vacancies' which the British Institute of Radio Engineers has been able to fill. As further adjustments in industry become necessary, there will be more opportunities of this kind may arise. Meanwhile, the Institution's war effort, referred to in my presidential address in December, 1939, has been continued with marked success. The expressed thanks of the War Office, the Air Ministry and the Ministry of Aircraft Production, besides other Government Departments and large bodies, for our work, indicates the official recognition of the professional status of the Institution's membership."

Council's nomination of Dr. C. C. Garrard, Ph.D., M.I.E.E., M.Brit. I.R.E., was unanimously approved by members, and Dr. Garrard therefore succeeds Sir Arrol Moir as president of the Institution.

The meeting concluded with the adoption of a proposal to inaugurate a building fund and an address by T. D. Humphreys (Associate member), of A. C. Cossor, Limited, on "Lesser Known Aspects of Measurement with the Cathode Ray Oscillograph."

The election of the 1941-2 general council, carried out by a postal ballot, resulted in the election of the following:

- Mr. A. L. Beedle
- Dr. P. P. Dalton
- Mr. A. G. Egginton
- Mr. J. F. Paull
- Dr. J. A. Sargrove
- Mr. L. Grinstead
- Mr. W. D. Sell
- Mr. G. Lea
- Mr. H. Tibbenham.

Office cadets undergoing Morse code practice under a sergeant-instructor. The young cadet on the extreme left is the third Earl Kitchener of Khartoum, grand-nephew of the famous soldier who raised a volunteer army of over a million men in the last war.
War-time "Hook-ups"

Circuits of Simple Sets Made by Readers During the War

In response to Thermion's invitation in our June issue to readers to send in ideas for hook-up and simple receivers for use in the present difficult times, we have received many circuits and descriptions of such sets, and we publish a selection of the best ones.

Several readers submitted circuits of one- and two-valve sets, and in our opinion the best effort was sent in by A. W. Jump, of Dunfermline, Scotland, who writes as follows:

"I was called upon to construct a set at short notice and within a limited time— in a town in which I was a complete stranger. I managed to rig-up a serviceable affair (I refrain from calling it a radio set) not without many setbacks. I had no components handy, and a tour of the town's radio shops unearthed 250 turns of the D.C.C. wire on to a 'deep' cotton reel. The two switches and the knob of the reaction condenser were the only controls, and these were mounted on the outside of the box."

"The aerial was introduced into the circuit by means of either of the pre-set condensers and the coil tappings. Connections to the coil were made by means of a piece of flex held secure by a small 'paper clip'."

"One of the condensers was then adjusted until the 'Home Service' could be heard, and the tuning switch reversed. The 'Forces' programme was then tuned by the other pre-set, and by selection of a suitable coil tapping. Thus either programme could be heard at will, simply by operation of the tuning switch."

"Results on this set, using a moving-coil speaker (W.B. Universal) were quite satisfactory, and although located at between fifty and sixty miles from the two 'local' transmitters, this little 'hook-up' provided adequate volume to fill a room 16 ft. square. It has been in use for over twelve months, and my friend has done nothing to it except change the accumulator and the H.T. battery (the latter only once)"

A Four-valve Circuit

A much more elaborate circuit is that of J. Robinson, who writes as follows:

"The accompanying circuit diagram is of my war-time junk-box set."

"The H.F. stage was added later in order to increase the volume of the Forces programme. The wave-trap helps to stop that fool Haw-Haw from cutting in on the Home Service programme, and is also used as a volume control. The set is run from an A.C. power jack, the speaker being mains energised from a metal rectifier, but of which I have no details. The L.T. is trickle charged."

"This set has been used continuously since just after the outbreak of war, and has never given the least trouble."

Simple One-Valver

A useful and cheap little one-valve circuit was submitted by M. Lockwood (Wakefield). Here is his description:

A useful and cheap little one-valve circuit was submitted by M. Lockwood (Wakefield). Here is his description:

"The valve used in this simple circuit was a Mullard P.M. H.F., and I have received all the English stations (these tests were carried out just before the war) and several continental stations at good phone strength."

"It could be coupled to a transformer and/or an R.C.C. stage and used with loud speaker."

"The details for the medium-wave coil are shown in the sketch. The first tapping on the coil (grid winding) should be, in most cases, the one used, but if there are two stations on top of one another the second tapping should be used."

"The valve used in this simple circuit was a Mullard P.M. H.F., and I have received all the English stations (these tests were carried out just before the war) and several continental stations at good phone strength."

"It could be coupled to a transformer and/or an R.C.C. stage and used with loud speaker."

"The details for the medium-wave coil are shown in the sketch. The first tapping on the coil (grid winding) should be, in most cases, the one used, but if there are two stations on top of one another the second tapping should be used."

Circuit diagram of A. W. Jump's two-valver.

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A Four-valve Circuit

A much more elaborate circuit is that of J. Robinson, who writes as follows:

"The accompanying circuit diagram is of my war-time junk-box set."

"These are the wave-trap helps to stop that fool Haw-Haw from cutting in on the Home Service programme, and is also used as a volume control. The set is run from an A.C. power jack, the speaker being mains energised from a metal rectifier, but of which I have no details. The L.T. is trickle charged."

"This set has been used continuously since just after the outbreak of war, and has never given the least trouble."

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"This set has been used continuously since just after the outbreak of war, and has never given the least trouble."

Details of an improvised valve-holder.
The theoretical circuit of M. Lockwood’s single-valve, and details of coil.

"If a long-wave coil is wanted it is better to fit plugs at the points shown and mount sockets on a strip of ebonite fitted on two blocks of wood.

"Long-wave coil former of the same dimensions can be used, but 200 turns of No. 34 single silk-covered wire, with tappings at the 100th and 130th turn, are required for the tuning section, and 75 turns of the same wire will be needed for the reaction winding."

Two-valve Mains “Hook-up”

From amongst the circuits of mains-operated sets submitted, we have selected that of J. E. Woodward (Wolverhampton) as being the best "mains" effort. It is quite a useful and reliable "hook-up," and here is Mr. Woodward’s description: "The accompanying circuit diagram is of a very simple two-valve, all-mains set, which is used in the living-room as a standby radio set, yet it can produce a sound that can drown a symphony or jazz orchestra. Its amplifier is no heavier than an average telephone relay. When the keys are pressed, they throw in contacts, switching in a system of resistances."

Frequency Range

Each of the usual musical instruments, such as the violin and trumpet, has a limited range of frequencies. The frequency range of this electrical instrument, on the other hand, is very broad, including that of many musical instruments. By simply changing the resistances the performer instantaneously changes the pitch. The compensator may produce a staccato sound like that of a guitar and a drum, or the legato sound of a trombone. In the high registers the sounds produced by the instrument resemble that of an oboe or a flute.

The performer plays only the basic melody; all the remaining effects conceived by the composer, all the colour, are achieved electrically, with the aid of an ordinary audio-frequency oscillator (producing electrical vibrations which, upon passing through the loudspeaker, are transformed into sound), electrical resonators, filters, resistances.

BROADCASTING WITHOUT A MICROPHONE

The problem of developing musical instruments capable of producing powerful yet clear and undistorted sound, audible to audiences of many thousands, has engaged the attention of Soviet scientists for some years. The Acoustics Laboratory of the Conservatory of Music, headed by Professor N. Garbuzov, has been working on the development of new electrical instruments, a task in which designers and manufacturers, working in close co-operation, are opening up new paths for the development of music.

In the laboratory stands a highly-polished black instrument outwardly resembling a miniature organ. When the musician raises the lid and strikes the keys, just as with a dummy piano, no audible sound is produced. The various valves, resembling those produced by a flute, an oboe, or even an organ, issue from the loudspeaker of the receiving set as the keys are pressed. This new electrical instrument, called a companola by its inventor, Igor Simonov, works on the same principle as a piano. Unlike a piano, however, each key is not attached to a hammer which strikes a string, but to a switch resembling a telephone relay. When the keys are pressed, they throw in contacts, switching in a system of resistances.

Frequency Range

Each of the usual musical instruments, such as the violin and trumpet, has a limited range of frequencies. The frequency range of this electrical instrument, on the other hand, is very broad, including that of many musical instruments. By simply changing the resistances the performer instantaneously changes the pitch. The companola may produce a staccato sound like that of a guitar and a drum, or the legato sound of a trombone. In the high registers the sounds produced by the instrument resemble that of an oboe or a flute.

The performer plays only the basic melody; all the remaining effects conceived by the composer, all the colour, are achieved electrically, with the aid of an ordinary audio-frequency oscillator (producing electrical vibrations which, upon passing through the loudspeaker, are transformed into sound), electrical resonators, filters, resistances.

Moreover, to play the companola does not require as much effort or as complex a technique as to play a piano. Without its amplifier it is no heavier than an average radio set, yet it can produce a sound that can drown a symphony or jazz orchestra. The musician, without exerting himself in the least, can make the instrument sound a “fortissimo” which, for power, is beyond anything so far known in instruments.

One of the usual sights at concerts is the tympanist, in the last row of the symphony orchestra, endlessly tuning his unwieldy instrument. And when he does play, he usually strikes only a few times in an entire number. In the Acoustics Laboratory of the Moscow Conservatory of Music was a small suitcase that resembles anything but a tympana.

The frailest girl may make the most powerful sound issue from your loudspeaker by applying her little finger to this "tympany," Simonov, the inventor, stated. As for tuning it—our "tympana" is equipped with a keyboard. Press the required key and without any tuning the sound you need is produced.
Brains Trust Again

I do not refer to the many dozens of letters I have received upon the so-called Brains Trust. On the principle that what I write always means something to only one of my readers I intentionally dislike publishing letters savouring of flattery. Much more potent to publish letters not approved of than must admit that on odd occasions there is the other point of view. So from my postbag relating to the alleged Brains Trust I extract a letter written by one Beauchamp, who hails from the salubrious district of Coventry, and this is what he says: "I disagree with your remarks in their entirety. I appreciate constructive criticism but are your remarks constructive? I would refer to your derivative, ribald suggestions as to a better title for the programme. It would appear that you doubt the mental powers and are unable to face criticism. The questions asked are, in the main, those which the public are unable to answer."

Professors

This reader is justly entitled with everything I wrote. I have said that I do not doubt the ability of the Professors in their respective spheres. Perhaps I suffer from some reflex action engendered by my school days in that I dislike professors. To many it is a magic word like the word Editor. To me it merely denotes, as I have said before, a sort of snobbery to absorb and remember the teachings of others; and I have already pointed out that the many thousands of professors we have had since professorships were first introduced have not contributed anything measurable to science. And what is a professor? You have Professors of Conjuring, Professors of Tattooing and Professors of Dancing. Normally, however, the term is taken to mean one who has held a Chair at a University. Readers will excuse me, therefore, if I fail to doff my hat in awe and deference to professors. I have a measure of respect for Professors of Exact Sciences, such as Professors of Mathematics, Professors of Engineering and so on. I am not impressed by Professors of Psychology, nor by Professors of Economics, for they are inept and very nebulous studies.

Regarding the questions I am quite unimportant in my criticism. The fact that a professor or two thinks what he love is a form of temporary insanity or that a man excelling effort pulls faces to frighten away his competence is of little value unless you can add any more to the world's heritage of knowledge than the views of any other member of the public. They are plain, contemptible musings which could be given by anybody. Another point. If a question is asked it should be answered in a positive way, leaving no room for doubt, and the gravamen of my criticism was that it is easy to propound questions, capable of many equally nebulous answers and providing, as I said, the opportunity for scientific guessing and idle, dreamy, window-room back-chat. I agree with my correspondent when he suggests it might have been useful to have added Sir Wm. Bragg to the Brains Trust, but whilst there are many important, scientific questions capable of exact answers which the public ought to know, we should not waste valuable broadcast programme space here such balderdash. I appreciate that the members of the Brains Trust are very much victims of those who set the questions and, left to their own devices, I have no doubt that they could give us a more entertaining half-hour. A further point occurs to me. If we are to have a Brains Trust let us call the members of it from time to time. As it is, the presumption is that only about four people in the country have brains. A suggestion, I add with some asperity, which I strenuously resent!

Feature Speakers

This is particularly true of feature speakers. Variety is the spice of life and the very quintessence of entertainment. Therefore, I adjure the B.B.C. to provide not only variety of entertainment but variety in their variety, if you get my meaning. No, friend Beauchamp, when looking up the vaticinal pet, remember the old quatrain which goes like this:

Ye, who your lips would keep from slips,
Three things must you beware,
Of whom you speak, of whom you speak,
And When and Why and Where.

The usual enjoinder of the critic appeared at the foot of this letter to the effect that if I ignore it he will presume that I am unable to face criticism. Well, I think I have effectively taken the sting out of R. B. W. L. Young (Capt., R.A.M.C.), Halifax.

Our Roll of Merit

Our Readers on Active Service—Eighteenth List.

H. Eltringham (A.C.2, R.A.F.),
A. Brewer (Sgt., R.A.F.),
H. G. Baker (Signalman, S.S.C. Coy.),
S. Peers (A.C.2, R.A.F.),
C. Waywell (A.C.2, R.A.F.),
W. L. Young (Capt., R.A.M.C.),
London, E.C.
Malton, Yorks.
Newcastle-upon-Tyne.
Newton-In-Wills.

Books and Periodicals

University Presses and Departments

The British Association for the Advancement of Science, London, W.C. 2.

Gray Memorial Trust Award

The Council of the Royal Society of Arts annually offers a prize of £50 under the Thomas Gray Memorial Trust. The objects of which are the advancement of the science of navigation and the scientific and educational interests of the British Merchant Marine.

The prize for 1940 has been awarded to Mr. H. C. Walker, of Cheam, Surrey, for a device known as the Portable Valve Lifesaving Equipment, which is a self-contained radio auto-transmitter designed for the purpose of saving life at sea. A similar prize of £50 is offered for 1941. For details apply to the Royal Society of Arts, John Adam Street, Adelphi, London, W.C. 2.
ROUND THE WORLD OF WIRELESS

September, 1941

U.S.A. Television

We are informed that as from July 1st, television broadcasting in the United States has been placed on a commercial footing by the Federal Communications Commission. The service will include the use of 525-line pictures, and the minimum programme service which each station must provide will be 15 hours per week.

Interference Suppressors in Germany

It has been decreed by the Minister for Transportation in Germany that all new motor vehicles with combustion motors must be equipped with radio interference suppressors.

Russia's Radio Relay

RECENTLY the Russian Government ordered the surrender of all privately-owned wireless sets.

This was a precaution against enemy exploitation of the Russian system of transmitting Government instructions by wireless. Shortly afterwards, Stalin gave his powerful broadcast. How was it affected by the order? The answer is that throughout Russia there is a Government transmission received through an apparatus they term a house receiver. Sets are sold, and the Russian Government's wireless communication with its people is maintained.

Epilogue Carried on During Blitz

MR. J. S. DE LOTIBERIE, B.B.C.

West Regional Director, told the story recently to the Bristol Rotarians of how the broadcast of a Sunday night epilogue was carried on during the height of a blizzard.

B.C. singers could not get to the studio, but Dr. J. W. Welch, Director of Religious Broadcasting; Paul Beard, leader of the B.B.C. Symphony Orchestra; and Stuart Hibberd, chief announcer, went down to a tiny underground studio made ready by engineers who were in a small emergency control room next door.

While bombs fell and anti-aircraft guns roared outside Paul Beard, kneading down to be near the microphone, played Bach's "Air on the G string" on his violin, while Dr. Welch and Stuart Hibberd sat on the floor to speak the epilogue.

Canada Calls from London

EVERY week a programme entitled "Canada Calls from London" is broadcast by the B.B.C. to Canada. This broadcasting period to Canadian listeners consists of two main features; namely, a "Newsletter in French," in which French-Canadians of all military ranks will be able to tune in, and "Canadians with Wings." This will be a weekly report on the activities of Canadians serving with the Royal Canadian Air Force and the Royal Air Force, and the broadcasts will be given in collaboration with the Canadian Broadcasting Corporation.

To Hear Their Parents

ONE of a fortnight British children evacuated to South Africa will hear their parents' voices in a new series of broadcasts in the B.B.C. South African service. Every eight weeks children will speak to the parents. The illustration on this page shows some of the parents at one of the broadcasts.

Parent's voices in a new series of broadcasts.}

Receiver Sales in Haiti

It is reported that approximately 400 radio receivers were sold in Haiti during 1940, 80 per cent. coming from the U.S.A.

400 mc. Record

A RECENT report from America gives news of an amateur 400 mc. record, flat slate, transcribed and analyzed short-wave broadcasts from foreign countries. These new communications are being set up on the recommendation of the Defence Communications Board.

C.M.T. from Delhi

THE four Delhi transmitters of All-India Radio now broadcast the Greenwich time signal. The B.B.C.'s transmission of the signal is received at the Delhi receiving centre and then re-broadcast. In order to cut out the B.C. programme when the time signal is superimposed thereon, as is sometimes the case, a filter has been incorporated in the receiving equipment which eliminates all but the frequency of the "pips."

WLW's Altered Time Schedule

STATION WLW, Cincin-

nati, has altered its operating times a half-hour forward, and now goes on the air at the earliest hour in its history — 5 a.m. E.S.T. The station will sign off at 2 a.m. E.S.T. Previously, the sign-on was at 5.30 and sign-off at 2.30. Under both the old and new schedules, WLW's operating span is 21 hours a day.

Radio Amateurs Wanted

MEN suitable for training as wireless operators are still wanted by the R.A.F. They must have a good standard of education, preferably with some knowledge of radio science—enthusiastic wireless amateurs, for example.

Telling America

WAR queries by Americans are to be answered by experts broadcasting overseas in a new weekly B.B.C. feature called "Answering You." It is expected that Sir William Beveridge, University College, Oxford, Mr. Francis Williams and Mr. T. Harrison will be among the permanent members of the Panel who will answer the American questions every Sunday at 2 a.m. (British time).

Sales of Sets in Canada

A NEW record for sales of radio sets was set up in Canada last year, the increase over 1939 being 18.1 per cent. The production of receivers in the Dominion increased by over 40 per cent. The production of valves rose by 63 per cent. Of the 385,000 receivers sold, 57 per cent. were sold by the broadcasting band only, whilst the remainder covered all but the medium and short-wave bands. The number of receiving licences in Canada is now well over 1,500,000.

A New Vest-pocket Book!

WIRE AND WIRE GAUGES

By F. J. CAMM

3½ or 3¾ by 5½, from George Newnes, Ltd., Tower House, Southampton St., Strand, W.C.2.
Valve Constants and Characteristics

How to Understand and Make Use of the Data Supplied by the Valve Manufacturer

EVERY reader has heard and read of such terms as mutual conductance, amplification factor, anode resistance, anode dissipation and voltage amplification factor, but how many are completely familiar with being meaning of these expressions? It is worth while taking a little trouble to understand them, and the study of elementary valve theory can be very interesting.

Let us start by considering the simplest type of valve—the diode. This is a valve in the true sense of the word, since it is primarily a "one-way" device, just as is the valve in a cycle tyde. If we connect a heating supply to its filament or in the case of indirectly-heated types, the heater, and then connect a source of D.C. between the anode and cathode, a current will flow round the circuit provided that the anode is made positive with respect to the cathode. If the polarity of the voltage between the two electrodes were reversed, there would be no flow of current, the valve acting as a very good insulator.

Diode Characteristic Curves

Suppose we refer only to the first-mentioned connections and the circuit shown in Fig. 1: the current flowing round the circuit can be measured by means of the microammeter shown in broken lines. If we were to vary the voltage (we may call it H.T. voltage) from zero upward, it would be found that the current shown by the microammeter would rise by 20 volts or more. It will be well to agree that in all cases the anode becomes quite a good conductor when the grid is made positive with respect to the cathode; similarly, we could reduce the flow of electrons by making the grid more negative. It will be of interest to note that if the grid were not connected, the main electron flow would be from the cathode to the grid.

By using the simple test circuit shown in Fig. 3 we can obtain some interesting results. One of the most interesting is that the anode current is changed to a very much greater extent by altering the grid potential, or bias, by one volt, than by altering the anode voltage to the same extent. In fact, it is often the case that an alteration of one volt on the grid is equivalent, as far as anode current is concerned, to altering the anode voltage by 20 volts or more. It is not difficult to appreciate why this should be so, because the grid is much nearer to the cathode than is the anode, and all the electrons passing to the anode must pass through the grid, so that it has a far greater "controlling force."

It is the ratio of these two voltages which we describe as the amplification factor. This factor—generally indicated by the Greek letter $\mu$—varies according to the actual anode and grid voltages applied to the valve, and therefore it is customary to give the figure applicable to an anode voltage of 100 and a grid voltage of zero.

Triode Characteristics

We will return to this factor later, but it will be better in the meantime to deal with some of the other valve constants. Fig. 4 shows a series of so-called anode current-anode volts curves which are applicable to a small battery valve of the "HL" type. It will be seen that each curve is for a given fixed grid bias from zero to 4½ volts negative, and that the curves vary considerably according to the bias applied to the grid. From Ohm's Law we know that resistance is equal to volts divided by amperes: we can therefore find the cathode-anode resistance of the valve from these curves. Again, however, the figure is dependent upon the anode and grid voltages, so it is the recognised custom to take the anode resistance, anode impedance, or internal resistance (all these names are used to signify the same property) at 100 volts anode voltage and zero grid voltage. The "shorthand" for these terms, by the way, is $R_a$ or $R_{an}$ and $V_a$ or $E_a$, where the small letter set below the capital stands for anode and grid respectively. In a similar manner, anode resistance is often shown as $R_a$. Finding the Anode Resistance

Referring to Fig. 4, we find the point on the $V_a=0$ curve directly above 100 volts on the lower scale and draw a straight line which is normal or tangential to the curve at that point. This line is produced to meet the two axes; at the points at which it meets them we take readings. In the example shown it will be seen that the point chosen, a voltage of 120 (150—30) multiplied by 1,000; the 1,000 is to change m.A. to amperes. Thus, the anode resistance of the valve represented is 27,000 ohms. The $R_a$ for any valve can easily be found if the anode volts-anode current curves are available, but to obtain reasonably accurate results it is necessary to have curves drawn to a large scale, or to re-draw them on a large sheet of squared paper. If these curves were not available, they could easily be drawn by using the circuit shown in Fig. 2, provided that high-grade voltmeters of very high resistance were employed.

Finding the "Slope"

There is another type of characteristic curve which is generally given in the valve

The Grid in a Triode

Beyond that point we are not greatly interested in the diode, and we can deal with the more familiar triode, in which a grid is placed between the cathode and anode. We can still vary the current flowing through the circuit shown in Fig. 3 by altering the grid voltage, but we can also alter the voltage or potential on the grid. Thus, if the anode voltage remained constant at any positive value we could increase the flow of electrons toward it by making the grid more positive in respect of the cathode: similarly, we could reduce the flow of electrons by making the grid more negative. It will be well to agree that in all cases the grid is more positive than the anode—as it is in practice—because if the grid were not connected the main electron flow would be from the cathode to the grid.

Fig. 1.—Connections to a diode used to obtain figures for plotting a graph of the type shown in Fig. 2. A micro-ammeter is used to measure anode current.

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Anode Current (mA).

Anode Current (mA).

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It is the ratio of these two voltages which we describe as the amplification factor. This factor—generally indicated by the Greek letter $\mu$—varies according to the actual anode and grid voltages applied to the valve, and therefore it is customary to give the figure applicable to an anode voltage of 100 and a grid voltage of zero.

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Referring to Fig. 4, we find the point on the $V_a=0$ curve directly above 100 volts on the lower scale and draw a straight line which is normal or tangential to the curve at that point. This line is produced to meet the two axes; at the points at which it meets them we take readings. In the example shown it will be seen that the point chosen, a voltage of 120 (150—30) multiplied by 1,000; the 1,000 is to change m.A. to amperes. Thus, the anode resistance of the valve represented is 27,000 ohms. The $R_a$ for any valve can easily be found if the anode volts-anode current curves are available, but to obtain reasonably accurate results it is necessary to have curves drawn to a large scale, or to re-draw them on a large sheet of squared paper. If these curves were not available, they could easily be drawn by using the circuit shown in Fig. 2, provided that high-grade voltmeters of very high resistance were employed.

Finding the "Slope"

There is another type of characteristic curve which is generally given in the valve
PRACTICAL WIRELESS

September, 1941

It is very gratifying to note that in two
months listeners have raised for
charitable objects over £26,790.
Notwithstanding the manifold calls made at
this time on the generosity of a free-giving
people, the weekly B.R.C. "Good Cause"
appeals still maintained an enthusiastic and
generous response from listeners.

In March, as a result of five appeals, the
total of £10,346 15s. 2d. was raised, and in
April, four appeals produced a sum of
£10,443 16s. 8d.

The one which registered greatest re-
response was that made on March 23 by the
late Lord Stamp on behalf of the National
Children's Home and Orphanage. The
total subscribed was £6,654 17s. 11d.
This was followed by a further
appeal by Dr. Gordon
Thompson, on behalf of the British
Fund for the Relief of Distress in China.

The sum received was £4,627 3s. 10d.
Dame Meriel Talbot's appeal on March 16,
made in the interests of the Professional
Classes and Gentlemen placed in distressed
circumstances as a result of the war,
raised £3,839 15s. 3d. Next on the list
was the "Huts for the Forcés" appeal by the
Care of cripples, in whose interest an
appeal was made by Emlyn Williams.

Christopher Stone on March 9 managed
a sum of £1,659 15s. ltd. was raised
through Cardinal Hinsley's April appeal in the "Huts for the Forcés" effort
made by the Catholic Women's League. "Com-
forts for the Army," sponsored in the
broadcast by Major-General Williams, raised
£2,000.

Mrs. Churchill was instrumental in
bringing in £1,637 2s. 7d. to the Y.M.C.A.
Fund used for the provision of huts and
canteens, and the Norman Birkett appeal
on April 13 produced £856 16s. 11d. for
Boys' Associations.

Some other important valve constants
will be explained in a second and concluding
article.

(To be continued.)

WEEK'S GOOD CAUSE RESULTS

There were several important events
in the weeks covered by this article.

Micromhos or mA.-V.

Mutual conductance is sometimes—a
more correctly—expressed in micromhos
rather than in mA.-V. The mho is the
unit of conductance, just as the ohm is the
unit of resistance, and since one ohm
equals one volt divided by one amp, it
will be clear that one mho equals one amp.
divided by one volt. One micromho is,
therefore, one millionth of a mho. We can
therefore convert mA.-V. into micro-
omhos by multiplying the current by 1,000
(a million divided by 1,000 to change from
mA. to amps). The valve referred to
above would thus be said to have a mutual
conductance of 1,000 micromhos. The
practice of giving the conductance in
micromhos is chiefly confined to the
conversion of conductance of frequency-
changing, but this term will be dealt with in
the concluding article.

Amplification factor has already been
referred to briefly, but having gained an
impression of the meaning of internal
resistance and mutual conductance we can
return to this. The reason is that the
amplification factor can be determined by
multiplying together the R of the grid and
the Gm of a valve. This is because the R can
be described as the ratio of the powers of
the grid and anode of controll-
ing anode current, and since mutual conductance is the ratio of anode current to grid volts, while anode resistance is the ratio of anode volts to anode current. If the two ratios are multiplied together, the expressions for anode current can be found by dividing the anode current by the grid voltage required to produce the same change in anode current. In determining the amplification factor or R in this way it is important to remember that the current must be expressed in amps, not
milliamperes. For example, if a
valve had a mutual conductance of 1.5 mA.-V. and an anode resistance of 20,000 ohms, the amplification factor would be
1.5/20,000 or 75,000.

Voltage Amplification

A point which is often over-
looked is that the amplification factor of a valve is not neces-
sarily the amplification which the valve
will give when used in any particular
circuit. The actual degree of amplification
is known as the voltage amplification factor
or V.A.F., and its value is governed not
only by the valve constants, but also by the
current, voltage, and the amount of voltage which can be " borrowed" as voltage drop across it.

In passing, it should be noted that stage
gain, or the ratio of output to input voltage
is even less than the V.A.F., due to the fact
that the grid condenser and grid leak in
series are virtually in parallel with the
anode load resistor, and that these two act as a potentiometer feeding the grid of the following valve.

Mutual conductance, generally abbreviated as Gm. The mutual conductance is the
ratio between a very small change in anode current brought about by a very small
change in grid volts, and is taken at 100
volts anode and zero grid volts. It can be
obtained from the appropriate curve in
Fig. 5 by drawing a normal or tangent to
the 100-volt curve at the point where it
crosses the zero grid-volts axis. It has
been drawn as a chain line in Fig. 5.

As would be expected for the alternative
name of "slope," the mutual conductance
is found, after drawing the line by dividing
the milliamperes, indicated at one end of the
line by the volts shown at the other.
Actually, the line need not be drawn as
long as in Fig. 5, but if it is shorter, a
triangle should be drawn with the line as
the hypotenuse, and the vertical height
divided by the base. It can be seen from
the example that, at the point defined, a
current of 5.1 mA. in anode current is
brought about by a change of 5.2 in grid
temperature (from 3.2 to + 2). It can there-
fore be seen that the mutual conductance is
5.2/3.2 or about 1.6 m.A. per volt.

It was stated above that the mutual conductance is the ratio between two
very small changes, and it may now be pointed out that the changes we have
considered are by no means small. But
since the straight line is normal to the
curve, and since it is a ratio with which we are concerned, the result is the same.
It would not be practicable to take ratios of infinitely small changes, and the most
accurate results are obtained by making
the line as long as possible after making
quite sure that it is normal to the curve.

Microhms or mA.-V.

Mutual conductance is sometimes—of
and more correctly—expressed in micromhos
rather than in mA.-V. The mho is the
unit of conductance, just as the ohm is the
Remote Control Switching

The device described below was used as a remote control to change from Forces to Home Service stations. A trimmer from an old L.F. is used in conjunction with a simple bell unit. The trimmer is connected so that when current is switched on at the remote control end, the trimmer is switched out of circuit.

To use the switch on and off, and trimmer out of circuit, the set is tuned to the Forces programme. Switch current off (trimmer in) and adjust trimmer until set is tuned to Home Service, then by simply

A Cheap Morse Key

This accompanying sketches give some idea of how I constructed a very efficient morse key for the surprisingly low cost of sixpence. First, I obtained a door spindle with the appropriate holes at each end. In it I bored a hole just sufficient to allow bolt A to fit into it. This square spindle, was connected to a piece of ebonite (size 2 in. by half inch, approx.), by bolt B and at the other end of the spindle a small cupboard knob was cross-threaded into one of the holes, and the screw filed and soldered from beneath. To the base-board (size approx. 7 ins. by 3 ins.) a piece of bolt C, which was countersunk. One of the connections to the oscillator or buzzer is taken from nut D as shown. The metal bracket was then screwed on to the base, and the other connections to the buzzer taken from it. Bolt A is placed into a hole about half inch up the bracket, and nut E tightly screwed up. The spindle is placed on to this bolt, via the hole previously bored into it, and nut F screwed up so that the spindle is free to move up and down, but not sideways. It is advisable to oil bolt A slightly with some thin machine oil. From bolt B to bolt G on the bracket a very flexible piece of wire is connected to ensure an efficient contact. Then, through a hole previously drilled in the ebonite, a fairly long screw is placed. Between its head and the ebonite is a spring obtained from an old torch. Finally

A round headed screw is placed in at an angle at the head of the ebonite. Thus, with the aid of a screwdriver, the gap across nut D and the spindle can be adjusted to one's own requirements by this screw. Also, if the tension of the spring is too strong, the long screw enables this tension to be decreased.—D. R. TAYLOR (Hull).

Emergency Lighting

NOWADAYS, for “blitz” and other reasons, it is very desirable to have a reliable device for ensuring that one is not “left in the dark” by mains failure, or fuses blowing. The accompanying diagram illustrates a device which is giving every satisfaction. The wiring to lights (three in number) is switched out, of circuit.
AUTOMATIC volume control is extensively used in nearly all types of commercial superhet, but yet many home constructors appear to avoid it because they imagine that it involves "difficulties." That is not true, although there are some versions of the system which do involve the use of fairly complicated circuits; in general, however, such arrangements are suitable, or at any rate necessary, only for very advanced designs of receiver.

Variable-mu Valves

It may be desirable to run over the principles of A.V.C. before considering the practical details. Automatic volume control depends essentially upon the use of high-frequency and/or a frequency-changer valve of the variable-mu type. That is, the use of valves the amplification of which can be varied over a wide range by altering the standing grid-bias applied to them. Fig. 1 shows in a very general way how a variable-mu valve operates. This anode current grid voltage characteristic curve shows that the slope of the curve varies from almost a horizontal line at high negative grid voltages to a very steep one as zero grid voltage is approached. And since the "slope" or mutual conductance gives an indication of the gain or amplification provided, it will be seen that the gain can be controlled by controlling the applied grid voltage. For comparison, the corresponding curve for a non-variable-mu valve is shown by a broken line. In this case, anode current ceases when the negative bias reaches 5 volts; in other words, the valve is inoperative at any voltage in excess of that figure.

Cross-modulation

That is not the only failing of this type of valve, for when the grid voltage exceeds -5, the valve is working on the lower bend of its characteristic. When that occurs the valve tends to detect instead of, or as well as, amplify. And it must be remembered that the grid voltage is not only dependent upon the D.C. bias applied to the grid, but also upon the amplitude of the signal which is fed on to its grid. Thus, on a strong signal the valve starts to detect, and distortion results.

What is perhaps a more serious fault is that a strong signal from a nearby transmitter may be detected, although the receiver is tuned to another and weaker transmission. When this happens we have what is known as cross-modulation. The effect is that the audio-frequency portion of the local-station transmitter is superimposed upon the carrier of the required station, and we have a form of interference which cannot be prevented by making the tuning circuits more selective.

Manual V.-M. Volume Control

Due to the considerably longer slope of the variable-mu valve, this form of interference cannot happen, since there is a far lesser tendency for detection to take place. All this is rather incidental to A.V.C., but it does show the desirability of using V.-M. valves in a modern receiver; they may be either V.-M. pentodes, V.-M. valves of the S.G. type, or frequency changers. When using variable-mu valves manual volume control is possible by biasing the grid through a potentiometer—in the case of battery valves—or by using a variable bias resistance in the case of indirectly-heated valves. The connections for these are shown in simple form in Fig. 2.

Requirements of A.V.C.

Now let us look at the A.V.C. question. The primary object is to make provision for the output from the speaker to be maintained at a reasonably constant level regardless of the strength of the incoming signal. If this object is attained it follows that variations due to fading will automatically be "ironed out." It is probably true to say that the latter advantage is of chief importance.

How is A.V.C. obtained? By arranging that the V.-M. valves in the set (preferably the frequency-changer and the I.F. amplifier) receive a negative bias which is proportional to the strength of the audio signal which constitutes the output from the second detector. Of course, the "primary" output from this stage is audio or low-frequency, which is used to operate the L.F. amplifier. But if we can rectify a portion of the output and use it as negative bias we meet the requirements set out above.

The Methods of Automatic Volume Control Suitable for Incorporation in Home Receivers Here Explained from the Practical Standpoint

The Simplest Form

When using a diode type of second detector this is easily arranged, as shown in a simplified diagram in Fig. 3. When the secondary of the last I.F. transformer is connected to the single diode as shown, there is an audio-frequency voltage developed across the 5-megohm resistor,
C. SYSTEMS

Checking H.F.

In practice, it is not quite satisfactory to use the simplest form of circuit shown in Fig. 3, since a certain amount of H.F. may pass into the L.F. amplifier and cause instability. We therefore use a H.F. filter consisting of a resistor of about 50,000 ohms and a fixed condenser of 0.0001 mfd. as shown in Fig. 4. The A.V.C. bias is taken from the upper end of the two series resistors and fed to the controlled valves through condenser-resistor filters of the type shown in Fig. 3, using one resistor-condenser combination for each.

This is, at any rate, a workable circuit, but it suffers from one rather serious disadvantage. This is that a certain amount of A.V.C. bias is fed back to the controlled valves whenever any signal, no matter how weak, is received. As a result, weak signals are made still weaker, and therefore the advantages of A.V.C. are partially lost. What we require is a means of preventing the feedback of any negative bias until signals of some predetermined strength are tuned in. This gives rise to the very widely-used system of ‘delayed A.V.C.’, with which the signal must reach a certain level before additional control bias becomes effective.

Delayed A.V.C.

One method of providing for this is shown in Fig. 5, where the use of battery valves is assumed. In this case a further modification will be observed in the shape of a double-diode valve, which one diode is used for detection (D.1) and the second (D.2) is used only for A.V.C. Both battery valves are used in practice and usually be employed.

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may be fed from the same source, through a fixed condenser, as shown, and each diode has its own load resistor. Thus, in Fig. 5, R.2 is the load resistor for D.1, with R.1 as the H.F. stopper, and R.4 is the load resistor for the A.V.C. diode. R.3 is merely a potentiometer voltage control for varying the input to the L.F. amplifier.

It will be noticed that the lower end of R.4 is returned to a tapping point on the G.B. battery instead of to the earth line as before. Thus a small (and readily variable) bias is put on the anode of the A.V.C. diode, and until the signal voltage exceeds this figure, this portion of the double-diode valve cannot pass any current. When the signal voltage exceeds the delay voltage and the anode becomes positive, anode current flows, there is a voltage drop across R.4, and an A.V.C. voltage is applied to the controlled valves. The setting of the delay voltage can easily be done by trial, and will depend upon the number of controlled stages.

(Continued on next page)
MODERN A.V.C. SYSTEMS
(Continued from previous page)

valves and the input to the double diode. In the case of a mains set the delay voltage could be obtained across a portion of a potentiometer connected across the H.T. supply, or by making use of the bias resistor of an L.F. valve, as we shall see later.

Interval V.C. Action

On further examination of Fig. 5 it will be noticed that the A.V.C. diode anode is shown connected to the anode of the last L.F. valve by means of a broken line. This is to show that the bias applied is equal and generally better connection. The advantage is that tuning is not quite as sharp as at the anode as it is at the second L.F. transformer stage and prevents the tendency for the A.V.C. bias to fall off immediately the receiver is slightly detuned; if it did so, full amplification would not give the right-hand section of the transmission and accurate tuning would be made more difficult. And if the set were slightly mistuned in this way, pronounced distortion would be observed.

Fig. 6 shows a more practical and usual version of the circuit shown in Fig. 5. In this the diode anode is of a double diode triode valve for second detection, A.V.C. and first-stage L.F. amplification. The valve is indirectly heated, although the same bias could be used with a battery valve. This circuit is, in all its essentials, the same as that in Fig. 5, except that the delay voltage is obtained across the usual cathode biasing resistance which serves to bias the triode L.F. amplifier. Additionally, however, another resistor could be wired in series at the point marked with a cross if extra delay voltage were required. The value of 1.6 kΩ is, of course, dependent entirely upon the valve used, and is generally in the region of 1,000 ohms. The bias voltage is normally about 3, which is generally correct for the delay. In passing, it should be noted that if in this case the delay voltage is obtained by making the cathode positive in respect to the A.V.C. anode, this has exactly the same effect as making the node negative.

Controlling L.F. Amplification

One other slight objection to A.V.C. is that variations in volume may occur due to the larger output from the diode detector, on strong signals being applied, to the H.T. voltage is available, it need not be made of a double-diode pentode, but the circuit given is slightly easier to follow and generally better connected. The value of $R_6$ is, of course, dependent entirely upon the valve used, and is generally in the region of 1,000 ohms. The bias voltage is normally about 3, which is generally correct for the delay. In passing, it should be noted that if in this case the delay voltage is obtained by making the cathode positive in respect to the A.V.C. anode, this has exactly the same effect as making the node negative.

A Two-valve Short-waver

Here is a note from member 482, describing his 2-valve short-wave set, which should prove of particular interest to beginners.

"For the mains version I used a metalised M.H.I. detector and a plain M.H.I. for output, as these were the only two valves I had, with cathode to earth in both cases. The unusual part of the circuit is the reaction. It will be seen that it departs from the usual practice of the H.T.1

More Notes on Members' Activities

Hotting-up Experiments

Member 7,001 writes as follows: "Many thanks for membership certificate for B.L.D.L.C. I will inform you of my experiments, etc., in the near future. At present I am building a single-valve short-wave set using H.F. pentode, and am hotting it up to get the most out of it.

"Before the war I was the holder of an A.A. licence and just about ready for my full ticket, so you will understand my disappointment I am now concentrating on receivers with a view to getting the best out of them and when the war is over I hope to go on the air as a fully-licensed operator."

News from India

Member 6,992 (H. G. Baker), who is a signalman, stationed in India, sends the following interesting letter:

"Very many thanks for the membership card, for the B.L.D.L.C., and letter, also for insertion of my request for correspondence. Although I am still writing this at my old Q.R.A., i.e., W7SM, I have given you my new Q.R.A. in case I have moved out by the time you receive it.

"I shall be forwarding a report of my activities, at a later date, and sincerely hope it will contain something of interest to readers. My spare time is very short nowadays, but I will do my best. I'll ask Reg. Fox, 4ATYX, to help me now that he is on the air again, as I work him every day for a weather report."

Contacts Wanted

Member 7,007-J. Dibben, Philo, St. Michael's Road, Wareham, Dorset—wishes to get in touch with a young member who is interested in S.W. work, and also MW and DX reception.

Member 6,770-D. Cox, 25, Carnarvon Road, West Bridgford, Nottingham—wishes to correspond with any reader overseas.

Newnes' SHORT-WAVE MANUAL
6/-, or 6/6 by post from George Newnes, Ltd., Tower House, Southampton St., London, W.C.2.
Problems of Amateur Receiver Design -13
Operating Battery Sets from the Mains : Combined H.T. Units and L.T. Trickle Chargers

By FRANK PRESTON

LAST month the more conventional methods of supplying power to a battery receiver were discussed. It was shown, however, that dry high-tension batteries are not usually economical when the H.T. current is in excess of, say, 20 mA; even for lower rates, it is generally more satisfactory and less expensive in the long run to adopt other means of obtaining the H.T. current.

H.T. Accumulator Units
High-tension accumulators are suitable for discharge rates up to 30 mA or so, but have the disadvantage that charging often presents a difficulty. Milnes units—banks of nickel-alkali-type cells—are in many respects more convenient than the usual type of lead-acid H.T. accumulator, in that they can be charged from a standard six-volt accumulator. And it is obviously easier to have an accumulator of this type charged. In addition, it is less bulky and easier to transport to the charging station, even if provision for charging is not available in the home.

There are three main types of Milnes H.T. unit, for maximum discharges of 60, 30 and 15 mA respectively. All three are particularly trouble-free and, in general, more economical than lead-acid types. They have the disadvantage over dry batteries of being rather expensive in first cost; running costs, however, are very small. The principal feature of these units is that they are built into 120-volt assemblies and have a special switching system whereby all the cells may be in series (supplying 120-volts) or in series-parallel for charging from a six-volt supply.

Mains-operated Eliminators
It is not proposed to deal further with the supply of H.T. from accumulators, but instead to explain some methods of taking the high-tension current from the mains. It is not necessary to have the policy of this journal to recommend the use of battery sets when a mains supply is available, but there are many readers who, for their own reasons, still prefer to build battery sets. In any case, there is no difficulty in obtaining current supply from the mains, provided that reasonable precautions are taken and that the design of the eliminator is suitably worked out in the first place.

We may start by looking at the question from the point of view of the reader who is "on" D.C. As far as H.T. is concerned, all that he needs is a suitable means of smoothing the supply—which has a super-imposed ripple which would cause hum—and of cutting down the voltage to that required by the receiver. For smoothing, an iron-cored choke and a couple of large-capacity condensers will suffice, while the inclusion of a resistor will permit of the voltage being dropped to the maximum of 150, which is usual with battery valves.

A.D.C. Eliminators
A circuit for an eliminator is given in Fig. 1, although this also includes provision for charging the two-volt accumulator. The lamp and off switch shown toward the right of the diagram may be ignored for a moment while we look at the H.T. supply section. We have two fuses rated at 0.5 amp., one in each mains supply lead, for safety. Then we have a change-over switch, which should be of the standard Q.M.B. type. This is followed by a smoothing choke marked as having an inductance of 30 henries, and by a voltage-dropping resistor. Across the feed we have a couple of 4-mfd. smoothing condensers, which should be of the paper-dielectric type; a third condenser is shown in broken lines, and although it is not essential, it does help still further in ensuring that the supply is really well smoothed. It may be omitted when the unit is first made, and then added later if it is found that some additional smoothing is required. This depends a large degree on the nature of the mains supply.

It will also be observed that a 1-mfd. condenser is connected between the negative point and an earth lead. Actually, the earth lead from the receiver should be transferred to this new position. The purpose of the condenser is to prevent any possibility of short-circuiting the mains if the mains plug is inserted wrong way round or if the positive main should be earthed at the supply.

Component Specifications
All condensers should be suitable for a working voltage of not less than 250, whilst the choke

Correct Polarity
The mains plug would, of course, be of a type to suit an existing power or lighting point, and it should be connected to the power unit by means of good-quality lighting flex. Since the correct polarity must be obtained on D.C. working it may be necessary to reverse the plug in its holder when first trying out the eliminator, which will not operate the set if the polarity is wrong. Once that has been done it is worth while to mark the plug so that it can be inserted correctly at any future time. In the case of a three-pin plug, which is to be preferred, the leads should be reversed if they are found to be wrong.

Trickle Charging
Accumulator charging from D.C. is never an economical proposition when only a single accumulator is to be charged from, say, 230-volt mains. This is because 22 Volts is wasted. Nevertheless, the convenience of the arrangement may be considered worth while, especially when current is bought cheaply. Trickle-charging can be carried out very simply by inserting any ordinary electric light— which serves as a voltage-dropping resistor

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Dictatorship; 1941.

Section be original and should reach the Indian Hindustani (Urdu or Hindi script), on any who accompanied the 27th Battalion, and Major J. H. W. Lieut.-Colonel R. M. Hawkins, commanding gate, General Strickland was joined by Guard of Honour drawn up at the works in the vicinity of Enfield and Ponders End, "A" Company, to the -Empire, Big Ben has now known all over the world, has become a rival in the band of the Grenadier Guards. A recording specially made for the B.B.C.'s Empire Service includes the purpose by the Grenadier Guards Band now introduces each of the transmission periods of the day's broadcasting, and each of the announcements periods, "London Calling." In all, "The British Grenadiers -" is heard by overseas listeners ten times at periods of the day's broadcasting, and each of the announcements periods, "London Calling." In all, "The British Grenadiers -" is heard by overseas listeners ten times.

Ediswan Home Guard


The 27th Middlesex Battalion of the Home Guard is recruited from factories in the vicinity of Enfield and Ponders End, and the Ediswan factory has furnished the full complement of men of Xp. 2 Platoon, "A" Company. After inspecting the Guard of Honour drawn up at the main gate, General Strickland was joined by Lieut.-Colonel R. M. Hawkins, commanding the 27th Battalion, and Major J. H. W. Morgans, common using "A" Company, who accompanied him to the parade ground.

Indian Literary Competition

THE B.B.C. is inviting its listeners in India to write short articles in English or Hindustani (Urdu or Hindi script) not more than 18,000 words—or poems of not less than twenty lines (ten complete) in Hindustani (Urdu or Hindi script), on any one of the following subjects: Democracy, Dictatorship, Communal Unity in India; Pen Pictures of a Soldier. The B.B.C. offers a prize of £15 for the best article and £15 for the best poem. Contributions must be original and should reach the Indian Section of the B.B.C. by October 1st, 1941.

New Signature Tune for the B.B.C.'s Empire Service

AS a regular and most popular broadcaster to the Empire, Big Ben has now a rival in the band of the Grenadier Guards. "The British Grenadiers," a marching tune known all over the world, has become a signature tune for the B.B.C.'s Empire Service. A recording specially made for the purpose by the Grenadier Guards Band now introduces each of the transmission periods of the day's broadcasting, and each of the announcements periods, "London Calling." In all, "The British Grenadiers -" is heard by overseas listeners ten times at periods of the day's broadcasting, and each of the announcements periods, "London Calling." In all, "The British Grenadiers -" is heard by overseas listeners ten times.

A.C. Eliminator and Charger

A.C. mains are more usual than D.C., but the necessary eliminator is slightly more complicated due to the fact that a mains transformer and rectifier are required to step down the mains supply and to convert the A.C. into D.C. Fig. 2 shows a convenient type of circuit where provision is also made for charging the accumulator from a separate transformer and rectifier. The H.T. mains transformer should, of course, be chosen to suit the rectifier to be used, and in Fig. 2 it is assumed that a Westinghouse type H.T. 14 metal rectifier is to be used connected in a voltage-doubler circuit. This provides a maximum output of 140 volts, 20 mA, and the necessary transformer has a secondary wound to provide 80 volts at 60 mA.

Alternative Outputs

Two condensers are required in the voltage-doubler circuit, and these should be of the paper type and need have a working voltage of no more than 200. In addition there is a large smoothing condenser which should, for convenience and economy, be of the electrolytic type, rated at not less than 330 volts working. If greater H.T. outputs are required alternative rectifiers will be required and the transformer secondary should have an output appropriate to the rectifier chosen. Thus, the following rectifiers used as voltage-doubler (this arrangement is preferred owing to the greater ease of smoothing and lower transformer secondary voltage) require transformers with outputs as stated: H.T. 15 for 230 volts, 60 mA—140 volts, 120 mA; H.T. 16, for 330 volts, 60 mA—240 volts, 200 mA; H.T. 17, for 225 volts, 100 mA—150 volts, 300 mA. In the last-named case only the series condensers for the voltage-doubler circuit should have a capacity of 8 mfd. In all cases the voltage-doubler condensers should have a working voltage of two to three times the voltage of the transformer secondary, while the smoothing condenser should be rated at twice to three times the maximum H.T. voltage.

A.C. Trickle Charging

A very economical method of accumulator trickle charging is possible with A.C., since a transformer can be used to step down the mains voltage to that required to operate a 2-volt output metal rectifier. The L.T. transformer shown in Fig. 2 has a centre-tapped secondary, each half of which should give 4 volts at .3 amp. The output from the L.T.7 rectifier shown is 2 volts at .25 amp. The single-pole change-over O.M.R. switch shown serves to switch on the H.T. unit (in the "on" position) or to bring the accumulator on charge (in the "off" position). If it is not required to charge the accumulator at any time when the receiver is out of use, the two transformers can be disconnected by switching off the wall switch or removing the mains plug. As with a D.C. eliminator, switch the L.T. on before the H.T. and off after the H.T. It is not strictly necessary to disconnect the accumulator from the set while it is on charge, but some readers may prefer to do so since the voltage will be slightly in excess of normal while the accumulator is still on charge.

Mains units for A.C. receivers, and power supply for A.C./D.C. receivers will be explained in a later article of this series.

ITEMS OF INTEREST

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The "Fluxite Quins" at Work

"What "arabic language," cried EE.
"Someone being murdered, strikes me!"
"It's a blade soldering set. Without FLUXITE, no pets. He needs us, come on, all you three."

See that FLUXITE is always of "soft" soldering and ask for it. Priced to suit all pocketbooks.

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**TELEVISION EQUIPMENT**

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<th>Price</th>
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<td>Power Pack and Amplifier chassis, includes back transformer, power supply, etc.,</td>
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<td>Cochran Televison Chassis, two triodes, with transformer and complete chassis,</td>
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<td>Cathode Ray Tube-Manufacturers type, 6A.C., or 220-250 volts A.C. shock-proof,</td>
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<td>Four-valve, four-watt,</td>
<td>£5 0s. 6d.</td>
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<td>£5 0s. 6d.</td>
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**AMPLIFIERS**

Four-valve, four-watt, 220-250 V, A.C. shock-proof, heavy duty chassis, two transistors giving 2 watts output per channel controlled by small knobs and control knobs, 12-in. by 15-in. by 10-in. Cased in walnut. Absolute quality, complete with transformer, £6 15s. 6d.

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Ex-government, Special Horn type projection speakers, 9-16, 12-in. by 18-in. by 10-in. Cased in walnut. The complete instrument, £15 16s. 6d.

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---

**LONDON CENTRAL RADIO STORES**

23, Lisle Street, W.C.2 (GERARD 2969)
Various Arrangements for Dealing with the Problem are Described in This Article

If it were not for the amplitude limiting connection the noise impulse would have an amplitude L.

The adjustable tapping 3 on the diode load resistance is ganged with the adjustable contact arm 4 of the anode resistance 1, so that movement of the tapping 3 to the upper end of the diode-load resistance to increase the audio output of the amplifier, is accompanied by a corresponding decrease in the value of the anode resistance 1 to effect an increase in the potential supplied to the anode 2 of the amplifier. The length of the load line EF, FP, is thus automatically increased as the strength of the signal oscillations supplied to the control grid of the amplifier is increased. Where the received signal is subject to fading, the automatic volume control of any preceding HF amplifier should have a flat characteristic for optimum noise reduction.

Automatically-operating Circuits

Figures 4, 5 and 6, show automatically-operating circuits. An output amplifier stage in Fig. 4 is constituted by push-pull connected valves 6 and 7, the anodes of which are connected to the negative terminal S of the anode supply potential curve. An anode potential of the lines EF, EF', etc., represent the load line, the slope of which is a function of the output-circuit impedance determined by the particular valve employed. The anode swing of the valve is limited to the length of the line EF, EF' (the length of which is a function of the anode potential) being limited at the abscissa axis by the anode-current cut-off, and at the line AB by grid current. Thus, the length of the load line may be controlled by adjusting the anode voltage.

L.F. Amplifying Stage

Referring now to Fig. 2, a conventional diode rectifier and low-frequency amplifying stage is shown, and it will be evident that by changing the value of the anode circuit resistance 1, the potential supplied to the anode 2 may be adjusted at will to control the length of the load line EF, EF', etc., and so limit the maximum amplitude of signal or noise oscillations.

In Fig. 3 the broken line GH represents the maximum amplitude which signal or noise oscillations may have for a particular value of the anode resistance 1. If the amplitude represented by the line GH is so high that the signal oscillations, the envelope of which is represented by the solid line I, do not exceed the amplitude GH, then the signal oscillations will be reproduced in the output circuit. When, however, the input contains a transient noise impulse represented by the curve L, the maximum amplitude of the noise impulse occurring in the output circuit is limited to the amplitude GH as shown at K.

Bias Control

In operating the arrangement shown in Fig. 4, the potential across the resistance 9 has a D.C. component and an A.C. component of syllable frequency. This potential controls the bias of the grid 12 and thus controls the anode current. The valves 6 and 7 are connected as a Class-B power amplifier, the anode current of which increases approximately linearly with increases of input signal strength. At low signal strength the average anode current is relatively small, and the control grid 12 consequently has a small negative bias. The anode current of the valve 11 at this instant is relatively large, and in flowing through resistance 9 produces a large voltage drop which in turn greatly reduces the potential supplied to the anode 2 of the valve 5. The length of the load line EF (Fig. 1) for the valve 5, is, therefore, greatly decreased during periods of low signal strength. The reduction of the permissible anode swings is thus effected automatically.

As the strength of the audio signal increases, the anode current of valves 6 and 7 also increases, giving an increased drop across resistance 9, and causing an increase in the negative bias potential applied to the grid 12. The consequential decrease in anode current of the valve 11 results in a decrease in the drop across the resistance 1 so that the potential, on the anode 2 is increased giving a longer load line EF for the valve 5.
Treat yourself to this new radio experience . . . .

If it hadn't been for the war, you might-to-day be the proud owner of a new radio—enjoying a fresh thrill from your listening. Well, here's an idea. For a fraction of the cost of a new set you can get one of the latest Stentorrian Extension speakers. Install it in any room you like and then listen critically. The fine balance of tone, the vivid clarity of reproduction will delight you.

It will give you a fresh interest to your listening and a new pride in your home. Ask your dealer for a demonstration.

WHITELEY ELECTRICAL RADIO CO. LTD. - MANSFIELD - NOTTS.

RADIO RECEIVER CIRCUITS HANDBOOK

By E. M. Squire. A useful guide to circuits for members of the radio industry and radio amateurs. Includes a dealer in the stage models and combines general theory with practical information. Published by Pitman.

Radio Books You’ll Need

1. From bookellers or Pitman’s, Parker St., W.C.2
2. Wireless World says: "The book is so practical, so replete in facts, and so well arranged that the reader will gain the necessary knowledge to work in a logical manner."—It shows the reader how to do it and just how to do it. Third Edition. Published by Pitman.

ELECTRADIX RADIOS

Rectifier and Battery Chargers

All sizes. From one cell to large batteries. Wellingborough 1, 2 and 3 circuit chargers. B.G.G.I., etc., in stock.

METERS, Western and Turner moving coil, flush Sin, dial 500 m, also 1,000 m, new Sin, 3 m, moving coil meters. 2 in. Acme precision micro-meters, calibrated and signed in case. Baraki, 237. Moveable card and delivery note, so send inquiries early.

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 Morse Keys. Type B.1, a strong key. 5/- Bakelite base, type G.6. A telegraph key type. Hitchin, 6/-, single-handed, 9/6. The best key available in Type IV. 2/6. Special Government extending folding Fuller service key, few only. 1/6.


Multiple windings, no cost. Cambridge-Toss and send contacts. 10/-.

Cable-Base Nos. 1. 5/6. 2. 8/6. 3. 14/6. All these are used as they are or have some new captured contraband. Latest continental Morse Inker Tape Recorders for sigs. on paper tape.


Cambridge-Toss and send diode. 27/6 and cradle stand, 3/6.

TELEPHONES. We are often asked for the modern telephone. This we supply. Amplifies buzzer 'phone signals, 7/6.


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Practice buzzers, 3/6.

BUZZERS. Bakelite-cased practice buzzers can be used as they are or have some new captured contraband. Latest continental high-speed model. Baraki at 48/10.

MICROPHONES. Metal-clad! Mikes. can be used as they are or have some new captured contraband. Latest continental high-speed model. Baraki at 48/10.

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Gives 80 volts, .25 ma., useful in testing. GD.0.


MAINS MAGNETS, disc type, 2-poles geared. Gives 2/6.5 volts, 2/6. S.P.C.O.

MOTOR GENERATORS. One cell to large mains. 1.850 revs., 1/6. PET. 2/6.

Rectifier and Battery Charger. From one cell to large mains. 2,000 revs. to 58 r.p.m. Voltage 15 to 20 volts. 50 cycles, reversible, double shaft, enclosed, laminated. A. (C.

amps. and 460 volts. 200 m.a. £5.

WIRING, No. 23, 31/2, .004, 100 feet. £1. D.C. Connectors. D.C., 6-8 volts. 3-5 amps. and H.T. 400-600 volts. 36/-.

Bakelite cased. 5/6.

tactholders, wiring. S.M. and vernier micro.

Engine Sets

31/4 in. by 71/4 in. Earlier type. 31/2 in. by 7 in. Later type. 31/4 in. by 7 in. Current. C.F.G.1, etc., In stock.

From one cell to large mains. 1.850 revs., 1/6. PET. 2/6.

From booksellers or Pitman’s, Parker St., W.C.2

R.F. Cables. PREMIUM quality. 50 yards. £1.56. Please add postage on all mail orders.

Mains Magnet, disc type, 2-poles geared. Gives 2/6,5 volts, 2/6, S.P.C.O.

SWITCHES, Micro. 0.0005 mfd., boxed in tin. 1/6.

In this group valves are at a low price.

EDISON STEEL CELLS, A.8.. in stock.

Formo Condenser, .0005 mfd., boxed in tin. 1/6.

CONDENSERS. Fixed. G.P.O., 2 M.F.

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31/4 in. by 71/4 in. Earlier type. 31/2 in. by 7 in. Later type. 31/4 in. by 7 in. Current. C.F.G.1, etc., In stock.

From one cell to large mains. 1.850 revs., 1/6. PET. 2/6.
Limiting Action

The broken line M in Fig. 7 represents the instantaneous limiting action, and, therefore, the maximum amplitude of oscillations permitted in the output circuit of the valve 5. The extent of the limiting action through which the strength of the syllabic frequency component appearing across the resistance 9, the envelope of this component being represented by the solid line N. A transient static impulse appearing at the time t₁ is limited in amplitude to the value P. Without the limiting action, this static impulse would appear in the output circuit with the amplitude of R. The second transient impulse appearing at the time t₂ is limited to a smaller amplitude S since the strength of the syllabic frequencies appearing in the output circuit at the time t₂ is smaller than at the time t₁.

In the arrangement shown in Fig. 5, the operation is similar to that of Fig. 4, except that the change in anode potential for the limiting audio-frequency amplifier is effected by a valve in series with the anode supply.

Class B Amplifiers

A pair of high mu-type valves 16 and 17, are used. These Class-B power amplifiers, are employed for this purpose. The anode impedance of these valves changes rapidly with changes in grid potential. Assuming that an input signal produces a change in the anode current of the valve 18, then the anode current of the valve 19 will decrease, causing the bias potential on the grid of valve 17 to become more positive, thereby decreasing the anode/cathode impedance of this valve. A larger anode current flows through the valve 17 to supply the increased instantaneous value of anode current required by the valve 18. Similarly, increases in the anode current of valve 19 again results in a limitation in fact 10.

The average bias on the grids 20 and 21 is determined by the average drop between the points 22, 23, and 24, of the transformer winding, which in turn depends upon the average current through the valves 18 and 19. The latter is determined by the dynamic anode potential in the cathode resistances 26, 27. Since this potential drop varies at syllabic frequency, the average bias on the grids 20 and 21, and therefore the average impedance of the valves 16 and 17 will vary at syllabic frequency to produce corresponding variations in the value of the average anode potential supplied to the valves 18 and 19. In other respects the operation is similar to that of the Fig. 4 arrangement.

Potential Drop

In Fig. 8 the average potential drop across the valves 16 and 17 is represented as the potential E₃, and the average anode potential applied to the valves 18, 19, is represented by the potential E₄. As illustrated in this figure, the magnitude of the potential E₄ changes with the occurrence of the input signal strength. The sum of the potentials E₀ and E₃ neglecting the small bias voltage drop across the resistors 26 and 27 for a given input signal strength must, of course, equal the potential of the anode source which is assumed constant.

The strength of the anode potential is the output signal, and the strength of the input signals is given by the line E₀ of Fig. 8, while E₃ represents the relation between the input signal strength and the maximum output of the amplifier as thus limited.

Fig. 8 shows a modification of Fig. 5, in which a single high-mu valve 28, having similar operating characteristics to the valves 16 and 17 of Fig. 5, has its anode 29 connected to the positive conductor and its cathode 30 connected to the centre-tap 31 of the primary winding 32 of the output transformer. The taps 33, 34 are connected, respectively, through the anode and cathode 35 and 36, respectively, of diode rectifier 37, and through a filter resistance 38 and condensers 39, 40, to the control grid of the valve 28. The filter 38, 39, 40 is arranged to filter from the potential supplied to the grid 41, all potentials having a frequency higher than the syllable range of frequencies. The double-diode rectifier 37 has the advantage that it doubles the lowest audio-frequency signal components.

The control potential supplied to the grid 41 through the rectifier 37, controls the anode-to-cathode impedance of the valve 28, so as to adjust the anode potential supplied to the anodes of the valves 18 and 19. The operation of this modification differs only from Fig. 5 in the method of controlling the impedance of the valve 28 included between the positive conductor, and the centre-tap 31 of the transformer 32.

This system was developed in the laboratories of the General Electric Company, Schenectady, New York.

G.E.C. Sound Reproduction

An Improved Version of the "Microgram" Amplifying Equipment

The General Electric Co., Ltd., recently announced details of a modified and improved version of their "Microgram" amplifying equipment.

The new "Microgram" embodies a three-stage low-frequency amplifier with microphone and gramophone inputs, an induction gramphraphine motor, a moving-iron armature pick-up, a transverse-current type microphone, and 30ft. of connecting cable, all within a portable oak table type cabinet measuring 20ins. by 17ins. by 12ins.


The amplifier employs a MH41 resistance capacity coupled to a MH4, which is transformer-coupled to two PX25 arranged in push-pull in the power stage. The H.T. rectifier is an MH14. All are Osram valves. Dual input circuits permit the use of either microphone or pick-up, either independently or mixed. Both inputs can be independently controlled by volume controls located on a small panel let into the front of the cabinet. The only other control is the mains switch.

Power Handling Output

The maximum power handling output is approximately 14 watts, and the output circuit is so arranged that low impedance speakers of either 15 ohms or 7.5 ohms may be used. The microphone is a new high fidelity model, the polarising current for which is supplied by a battery incorporated in the amplifier. Thus the need for external batteries or other external D.C. sources is obviated. Normally, the microphone is resiliently mounted on a neat handgrip, but it is easily detachable, so that if desired it may be used in conjunction with a table or floor type stand. Details of these stands are available on request.

Compact and Portable

Being compact, portable and particularly robust, the "Microgram" is ideal for installation in factories, public halls and the like, where rough usage is likely to be the rule rather than the exception. A leaflet (No. BC. 9350), giving fuller details is available from The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Solution to Problem No. 422

H.F. oscillation was occurring in Roberts' receiver owing to inadequate screening of the H.F. components. It is difficult to provide adequate screening when an efficient H.F. pentode is used, because the output valve, although a meter connected from the anode of this valve to H.T.—indicated that maximum anode voltage was being applied. He therefore suspected the valve, but when this was tested it was found to be normal, and further tests indicated that the heater voltage was normal. What was wrong? Three books will be awarded for the first three correct solutions opened. Entries must be forwarded to The Editor, PRACTICAL WIRELESS, George Newsam, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Entries must be marked Problem No. 425 in the top left-hand corner, and be posted to reach this office not later than the first post on Monday, August 1941.

PRACTICAL WIRELESS

September, 1941

Problem No. 423

BAXTER'S three-valve mains receiver, using an A.C.C. Pilot, in the output stage, suddenly stopped functioning. He checked the anode current consumption of each valve in turn and found that no current was being taken by the output valve, although the maximum anode voltage was being applied. He therefore suspected the valve, but when this was tested it was found to be normal, and further tests indicated that the heater potential was normal. What was wrong? Three books will be awarded for the first three correct solutions opened. Entries must be forwarded to The Editor, PRACTICAL WIRELESS, George Newsam, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 423 in the top left-hand corner, and be posted to reach this office not later than the first post on Monday, August 1941.

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Sir Frank Gill, K.C.M.G., O.B.E., M.I.E.E., who had conferred upon him the honour of Knight Commander of the Order of St. Michael and St. George in the King’s Birthday Honours List, was invited by the Postmaster-General to a small reception at the General Post Office recently, in honour of his knighthood. Several distinguished guests were present.

It is interesting to recall some of the principal features of Sir Frank Gill’s long and distinguished career in the telephone industry. He joined the staff of the United Telephone Company in London at the age of 16, and rapidly rose to the important post of Engineer-in-Chief of the National Telephone Company.

This post demanded not only high scientific attainments and engineering ability, but abundance of tact, patience and diplomacy. Before its transfer to the Post Office the National Telephone Company had to withstand strong competition, and at the same time to weather many storms owing to frequent changes in Government policy.

After the transfer to the Post Office Sir Frank visited extensively what are commonly called “furrin” parts. He travelled as a consulting telephone engineer in the U.S.A., South America, Portugal and Turkey.

In fact, the only constant factor in the situation was the Government’s determined and consistent deduction of 10 per cent from the company’s earnings. On that point alone there was no vacillation or change in policy.

After the transfer to the Post Office Sir Frank visited extensively what are commonly called “furrin” parts. He travelled as a consulting telephone engineer in the U.S.A., South America, Portugal and Turkey.

But perhaps his greatest achievement came after his Presidential address to the Institution of Electrical Engineers in 1922. In that address he outlined the far-reaching international scheme whereby long-distance telephone circuits would be made possible throughout the continent of Europe.

Barry Kay has, for the time being, relinquished his position as radio sales manager of E. K. Cole, Ltd., in order to join the Board of Trade. Mr. Kay has been appointed Deputy Controller of Factories and Storage Premises for the South-western Area, and he took up his new duties at the beginning of June.
Children's Broadcasts from America

SIR,—In view of the considerable number of parents of children evacuated over seas, I wish to write to the B.B.C. with complacency that they have no receiver capable of picking up the weekly S.W. children's message programmes from Canada and America. I would like to suggest to amateur radio clubs who have the necessary accommodation, that they offer to arrange reception of these stations each week, on a reliable receiver in their "headquarters," in order that local parents may not miss the few seconds which are of so great a sentimental value to them.

I am sure that the local evacuation authorities would co-operate wholeheartedly in passing the necessary information to the parents concerned.

I understand that Messrs. Chappell, of Chipping, London, have kindly adopted this scheme, but, naturally, this is available only to those parents who can command London. Amateur radio fans who carried out this plan, at negligible cost to themselves, would be "doing their bit." In a highly commendable way, and I am sure that the general public would be grateful for this service.—PETER JACKSON (Letchworth).

Using a Doublet Aerial with a 4-pin Coil

SIR,—In past issues of Practical Wireless I have seen numerous suggestions for adapting a doublet-type aerial for use with a 4-pin short-wave coil. The following method I have used will be of interest to fellow short-wave experimenters.

First obtain a foot or two of 14 gauge tinned copper wire, and from this wind a three or four-turn coil, the diameter of which will allow a jin clearance when the 4-pin coil is mounted in its holder. Next obtain two ceramic stand-off insulators, 1½ in. high. The programme starts by playing "Loch Lomond" and ends by a sadly untuneful rendering of "(God Save the King." The times and wavelengths have been verified, and originally this station operated on 50.63 metres, changing to 25.05 metres on May 25th, 1940. Since that date it has been increased by the two additional wavelengths of 30.77 m. and 41.07 m. I hope this information will be of use to your correspondents.—JOHN E. W. WILLIAMS (RhyL).

Our Useful Handbooks

SIR,—I am now a radio-mechanic attached to the R.A.F. and I owe a lot to Practical Wireless for the numerous articles, etc., from which I picked up a lot of the equipment I have used.

While in Northern France and Belgium during the early part of the war, my wife used to send me a copy of Practical Wireless and through these I kept in touch with my old hobby. Your radio publications appeal to me very much, and up to now I have "Radio Engineer's Vest-pocket Book," "P.W. Service Manual," and "Television and Short-Wave Handbook," this latter one being published some years back. I must compliment Mr. F. J. Camm on the very clear and well-illustrated chapters in the "P.W. Service Manual." The others are equally well written, and form part of my regular reading matter.

Wishing Practical Wireless continued and deserved success.—W. E. WILLIAMS (RhyL).

Correspondents Wanted

SIR,—I am a beginner in radio, wishes to get in touch with another young beginner.

CWAYWELL, 10 Fern Avenue, Newton-le-Willows, Merseyside, wishes to correspond with any readers interested in S.W. work.

G. Packman, Morton Cottage, Fernhill Heath, Warrs, Worcestershire, wishes to get in touch with a young medium-wave enthusiast.

S. B. Gartner, Chesham School, Healdley, Newbury, Berks, who is a beginner in radio, wishes to get in touch with another young beginner.

T. & C. RADIO COLLEGE
29, Market Place, READING.

(post in unsealed envelope, 1d. stamp)

Please send me free details of your Home-Study Radio Courses.

NAME .................................
ADDRESS ..............................

P. 10.

PRACTICAL WIRELESS
September, 1941

Open to Discussion

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).
Outline of Musical History—23
By Our Music Critic, MAURICE REEVE

A t this point we can pause to consider how Beethoven's great misfortune of deafness affected him. He was just thirty, the idol of Viennese society, financially well off, and the great hope of the musical world. How magnificently he wrestled with the awful problem not only impelled the publisher to dub it quiet serenity and atmospheric suggestion, but also entitled him to the title of the "Mozart of pianists." While Beethoven was not so innocent as his mistreatment of his young pupil, he was a close friend of both Schubert and Schumann, and his influence on them was profound.

The works of Beethoven are divided into several periods. The first period is characterized by the use of a rapid tempo and forte dynamics, often with a strong sense of rhythm and drive. The second period is marked by a more relaxed tempo and a greater emphasis on melody and harmony. The third period is notable for its greater complexity and depth, with a focus on the inner structure of the music. The fourth and final period is characterized by a greater use of dissonance and a more radical reworking of existing forms.

Beethoven's contributions to music were revolutionary. He expanded the orchestra to include more instruments and added new elements such as cymbals and timpani. He also composed over 150 songs and over 30 symphonies, many of which are still performed today. His works include the Missa solemnis, the Eroica Symphony, the Violin Concerto, and the String Quartets. His music influenced many composers who followed, including Wagner and Mahler.

In terms of historical context, Beethoven's music was part of the Classical period, which was characterized by a focus on structure, form, and clarity. Beethoven's music marked the transition to the Romantic period, which emphasized emotion, individuality, and personal expression.

Beethoven's music was not only revolutionary in terms of form and structure, but also in terms of content. His music often reflected his own personal experiences, such as his struggle with deafness, and his works are often seen as a reflection of his own inner turmoil. His music has continued to be performed and studied to this day, and his influence on music is still felt today.
Faults in a Superhet

I have a commercial set which has a 6A9G converter and the values are freq. chg., H.F. pen, D.D. triode, pentode output, and rectifier.

"If the set is tuned to the medium and long waves there is just a rushing sound and an intermittent whistle similar to Morse. The same sound is also heard on the short waves. If I put my finger on the top cap of the 6A9G there can be heard very faintly one or two stations. This latter effect was only noticeable after replacing the valve."

"Can you advise me as to the cause of the trouble?"—A. T. Bullock (Rochester).

"It is very difficult to give an accurate diagnosis of the fault in your superhet without having more complete details or making a few simple tests, but it would appear likely that the coils or wave-change switches in the coupling circuits are at fault. On the other hand, the anode or screening-grid circuits of the frequency-changer could be disconnected, in which case they may give short waves but no other indication."

We suggest that you test for voltage between earth and the anodes and grids of this valve, and also check the interstage flowing to each of these electrodes. You might also make a careful examination of the wave-change switches and test for continuity of the coil windings—including continuity through the switches.

Make especially sure that there are no breaks in the aerial-tuning and input circuits to the first detector, since it is likely that an open circuit will be found somewhere in this region.

Replies to Queries

Q.S.L. Cards

"Being a new S.W.L. to DX I am unacquainted with Q.S.L. cards. Could you please furnish me with information about them?"—R. Russon (Dudley).

Q.S.L. cards and acknowledgments sent by transmitting stations, both commercial and amateurs, of reports sent to them of their transmissions, etc. At the present time there is no recognized method of sending such reports overseas. Brief essential items are required, i.e., type of receiver, weather, time, strength and quality of signal, interference and type of aerial in use. Normally a report is sent on logging a station. International Reply Coupons should be sent to cover the cost of reply.

All-wave Tuner

"While looking through your back numbers, I noticed in an issue of P.W. dated (I forget the date) an article headlined 'About All-wave Tuners.' Suggestions and diagrams are embodied for an L.M.S. coil, but no length or gauge of wire was specified. Can you supply me with these particulars as I should like to wind my own coil?

"The diagrams are embodied for an L.M.S. coil, but no length or gauge of wire was specified."

We wish to draw the reader's attention to the fact that Q.S.L. Service is intended only for the exchange of information, 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 free copies of completed multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contents.
(3) Suggest alterations or modifications to receivers described in our contents.

Submit queries through the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

"I have used the converter in conjunction with a PX4 triode as output valve."

"The only way I can see of doing this is to give the detector valve the bias resistor of the driver valve, but I do not know if the signal amplitude applied to the grid valve fed from the driver cathode would be the same as that of the other valve. Will you please let me have your opinion on the matter?"—L. McGee (London).

We cannot advise from experience on the suggested amplifier modification you propose, but we do not consider that it would prove very advantageous.

There would be many practical difficulties in balancing the output valves, and even if the method could be made successful we should anticipate that a good deal of experimental work would be necessary.

We should be more inclined to favour the use of parallel output valves—with suitable provision for loading them—owing to the advantages of a complete change-over to a parallel arrangement.

Microphony in S.W. Converter

"I recently made a short-wave superhet converter, operated in conjunction with a 5-valve mains receiver. It has operated perfectly as regards sensitivity, and I have received stations from all over the world. Its main fault about which I should like your advice, is a certain amount of instability in the form of microphony when the volume is increased.

"I have used the converter in conjunction with other receivers, and in all cases microphony is reduced when up full volume. None of these receivers show any signs of microphony when used on other wavebands, even on full volume. The fault therefore points to a microphonic detector.

"The only way I can see of doing this is to give the detector valve the bias resistor of the driver valve, but I do not know if the signal amplitude applied to the grid valve fed from the driver cathode would be the same as that of the other valve. Will you please let me have your opinion on the matter?"—L. McGee (London).

It cannot be avoided from experience on the suggested amplifier modification you propose, but we do not consider that it would prove very advantageous.

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Resistence of Headphones

"I want to make some experiments with crystals and a crystal set I have just finished. Does it make any difference what resistance the headphones have?"

"The headphone resistance should be determined by tone required. A similar effect can be obtained by fitting a filament rheostat in the grid circuit of the detector valve, although this is the most common source; variable condensers may also be used, and if necessary, be mounted on rubber buffers."

"I have built an amplifier, using direct coupling with a PX4 triode from a circuit you published some time ago. I was wondering if the excellent quality of DX I have heard is due to the arrangement this could be further improved by using two PX4's in push-pull."

"I have used the converter in conjunction with a PX4 triode as output valve."

"The trouble?"—A. T. Bullock (Rochester).

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