LOOKING AHEAD: SOME POST-WAR PROBLEMS

MONTHLY
ONE SHILLING

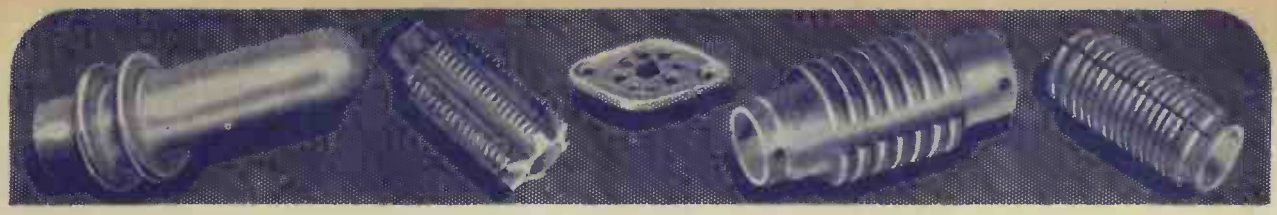
The Wireless World

COVERING EVERY WIRELESS INTEREST

NOVEMBER 1941

STEREOPHONIC SOUND ON FILM

No. 1073 Vol. XLVII No. 11



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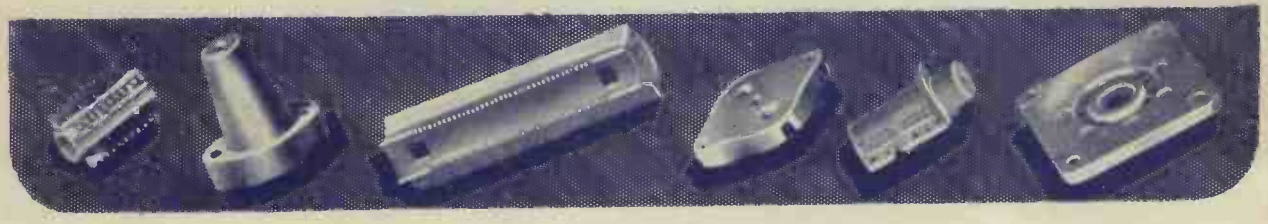


Lord Hankey's Appeal

TO THE WIRELESS TRADE

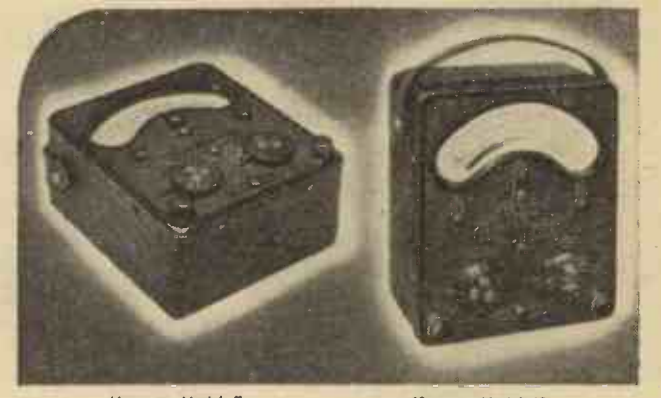
★

Multi-range Measuring Instruments wanted immediately for vital war training work

"I . . . appeal to you to-day to assist by selling or presenting this type of equipment if you have any surplus or if you know of any of your retailer friends whom you can persuade to part with such apparatus. The instruments I refer to are of the AvoMeter and AvoMinor class . . ."

LORD HANKEY AT THE R.M.A. LUNCHEON, SEPT. 17.

Radio is playing a vital part in the war . . it is the eyes and ears of every service and its job is expanding every day. Thousands more men must be trained as wireless mechanics—the schools and instructors are there—but multi-range measuring instruments are needed at once. Lord Hankey has appealed to wireless engineers and traders to help. If you have a meter of the type required that is not doing a full day's work every day, please give or sell it immediately.



46-range Model 7 Universal AvoMeter *40-range Model 40 Universal AvoMeter*

TYPES OF INSTRUMENTS REQUIRED: The instruments most urgently needed are multi-range AC and DC meters such as the Model 7 AvoMeter, the Model 40 AvoMeter, and the Universal AvoMinor. Offers of other makes of multi-range instruments of similar grades and capabilities are also welcomed.

WHAT TO DO: If you can release any of these types of instrument please communicate *at once* with Mr. R. P. Browne, B.Sc., Secretary, The Radio Manufacturers' Association, 59 Russell Square, London, W.C.1, giving the details enumerated below. Only instruments in working order should be offered. Do not send the actual meter until advised.

PLEASE GIVE THESE DETAILS: (1) Type of instrument. (2) Approximate age and condition. (3) Whether it is a gift or for sale. (4) If the latter, the price desired. (5) Name and full address.

The Universal AvoMinor

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This Page appears by courtesy of the Automatic Coil Winder & Electrical Equipment Co. Ltd., (Makers of "Avo" Instruments), to reinforce Lord Hankey's recent appeal, which is urgent and essential to the war effort.

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. . . of Britain's factories, from her shipyards and laboratories and mines has come many an invention, many a discovery that has changed the course of history. We search for and hold fast to whatever good we can. We know full well that by perseverance only shall we blot out hatred and destruction, misery and hardship and emerge with a fierce determination to make the world a better, safer place. It is our wish always to be associated with that spirit of true comradeship which shall be continued on through happier days.

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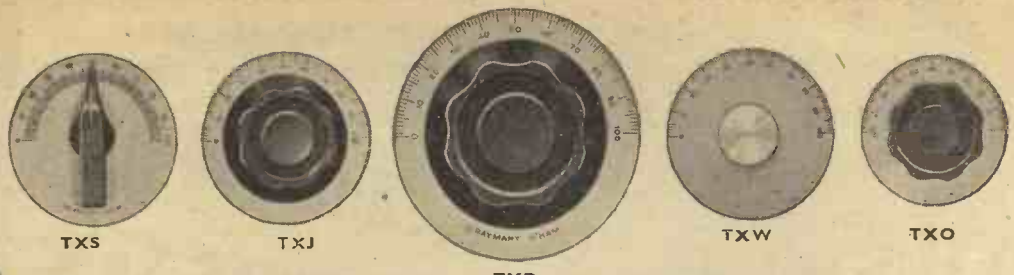

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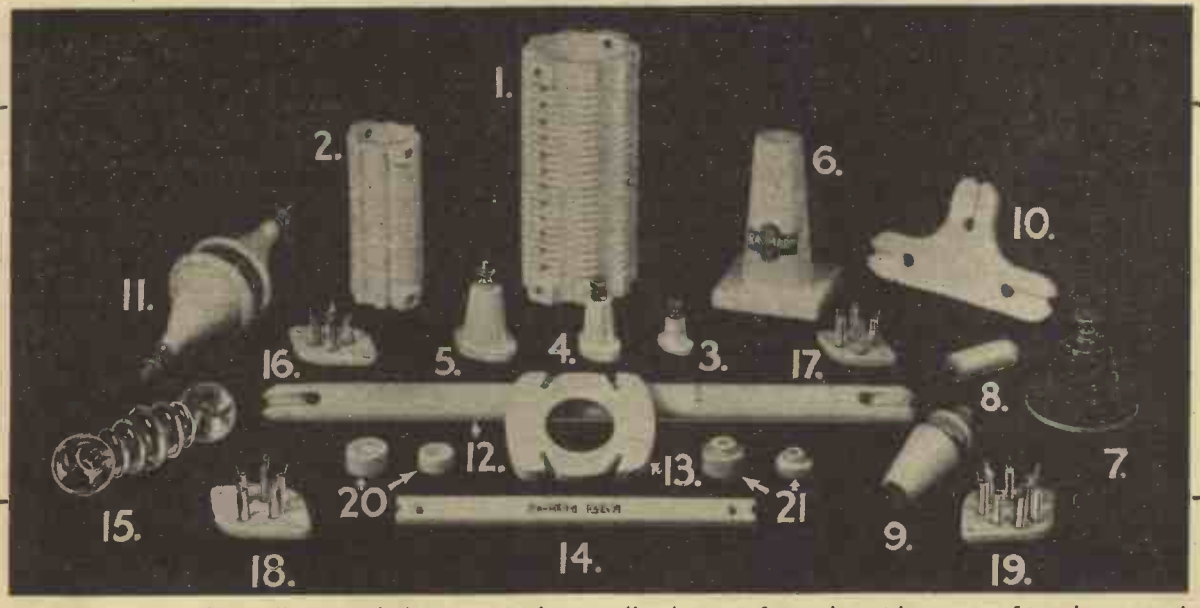

The twenty-one lines illustrated above are only a small selection from the wide range of insulators and ceramic goods available from Raymart, who carry the largest range of these products in this country. Whatever your requirements in Insulators and Ceramic Goods, send us your enquiries.

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The Wireless World

31st Year of Publication

Covering Every Wireless Interest

NOVEMBER 1941

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents.

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The
Wireless World

COVERING EVERY WIRELESS INTEREST

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Looking Ahead

Planning the Post-war World of Wireless

FORTUNATELY, it is no longer considered unpatriotic or inimical to the war effort to discuss plans for the post-war period, or to indulge in day-dreams about the changes we should like to see in the happier world of the future. And why not? Few of the relaxations that are open to us make smaller demands on national resources; and most of us are willing to face discomfort or privations all the more cheerfully if we have constantly before us the picture of a brighter future. In our own world of wireless we shall have an opportunity of making virtually a new start in many directions, while in others there will be at least a chance of righting some of the mistakes of the past. No apology need therefore be offered for devoting some space in this issue to problems that will become urgent when the war is over.

Technicians of the Future

Of all these problems, none will be of more immediate concern than the "re-settlement" of ex-Service wireless men, and it is an encouraging sign that the industry is already beginning to give serious thought to the matter. This subject, and the closely connected one of technical training, is touched upon in an article printed on another page, where the excellent suggestion is made that "refresher" courses for those wishing to adopt wireless as a civilian career should be instituted during the demobilisation period.

So far as broadcasting is concerned, the organisation and technical planning of the service, particularly in the international sphere, must obviously depend on the political situation. Whatever the position may be, the plan for a drastic change in wavelength that is put forward in an article we publish this month is worthy of serious consideration, if only because the adoption of an ultra-short-wave system for the home service, as suggested by our contributor, would probably help in popularising television. The re-establishment of that service will in itself be a major problem. Our contributor does not touch on frequency-modulated transmissions, but that is a possibility obviously not precluded from his scheme.

Repaying a Debt

To return to the ex-Service men. As to their number, we can do no more than guess vaguely that it will be very large. But of one thing we can be certain: the number will be much greater than can be absorbed by the industrial and other wireless activities of peacetime. However hard those who direct these activities may try to find a place for those to whom we owe so much, immutable economic laws (which will still govern whatever kind of world we are to live in) will restrict the number that can derive their livelihood from wireless. Many, however, will still retain an interest in wireless, and for them the obvious outlet will be amateur transmission. Facilities for them to embark on that most fascinating hobby must be made available.

The pre-war pretence that amateur transmission was restricted to serious experiments must be abandoned, and the avowed "hobbyist" must be officially admitted to exist. After the war, the right of everyone, and especially of ex-Service men, to indulge in the finest of all hobbies must be freely acknowledged. But, of course, this must be subject to proper safeguards.

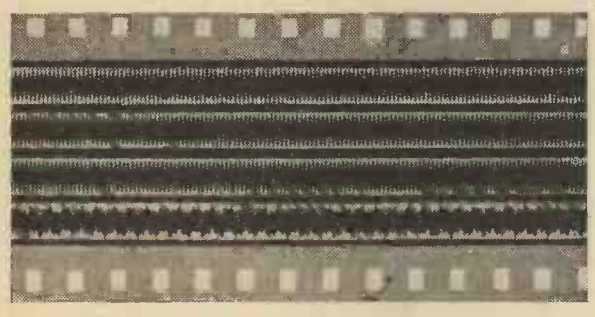
In no sphere of wireless must we be caught without a plan when peace returns, or the opportunity of making a new start may be irrevocably lost. We can at least establish now the broad principles on which detailed plans may be built up as soon as the future becomes clearer.

"Fantasound"— *Stereophonic Sound Effects in Walt Disney's Film "Fantasia"*

Stereophonic reproduction, which has been demonstrated to limited audiences on many occasions, takes a step nearer to commercial realisation in the orginal prints of the film "Fantasia" which, together with special auxiliary equipment, are touring the principal cinemas of the United States

WHEN the history of the development of high-quality sound reproduction comes to be written, a prominent landmark will undoubtedly be the sound tracks of Walt Disney's recent film "Fantasia."

In this film sound is not so much the accompaniment as the starting point of the ideas expressed in the animated colour cartoons shown on the screen. It is divided into eight sections, each taking for its theme a well-known musical classic played by a first-class orchestra, the Philadelphia Philharmonic, under the baton of Leopold Stokowski. It is not within the scope of this journal to describe the pictorial side, which will no doubt be enjoyed by those of our readers who see it, but we can give some details of the sound-recording technique developed by R.C.A. for the full-scale stereophonic reproduction of the music at the first showing of the film in the principal theatres of America.



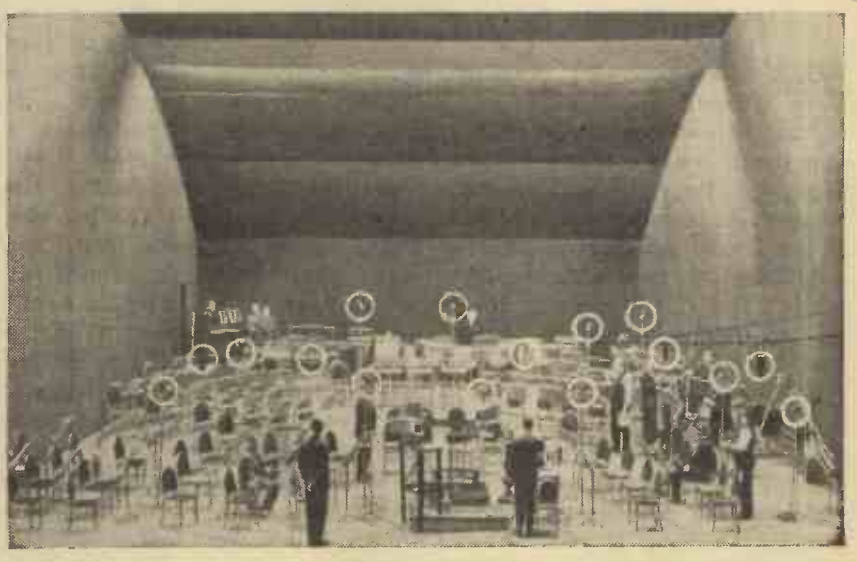
Test specimen of special sound track. The complex wave form contains the three control frequencies for volume expansion.

Special equipment was sent from place to place with the film and auxiliary loud speakers were installed to handle the large sound output and to ensure correct balance for the stereophonic effects. Unfortunately, the war has prevented the showing of the original prints in this country, but the specially combined single sound track which has been prepared for use with existing projectors bears unmistakeable traces of the unusual character of the original edition and of the subsequent adjustment of balance and heightening of contrasts in the orchestral playing by the conductor.

The raw materials, so to speak, from which the final sound tracks were composed, were drawn from microphones distributed at strategic points throughout the body of the orchestra. One of the accompanying photographs shows that at least seventeen pick-up points were used in the preliminary balance and control tests. Finally, eight simultaneous recordings were made with microphones at six points in the orchestra and two others as follows: (1) Violins, (2) Cellos, (3) Violas, (4) Brass, (5) Wood Wind, (6) Percussion, (7) Mixed output from whole orchestra, (8) Microphone pick-up at a distance from orchestra.

The last two sound tracks provided what might be termed first proofs of the recording. These were examined critically by the conductor and if the efforts of his players fell short of his ideals of what the music required, adjustments were effected when the final sound tracks were made up from the six primary channels arriving from different points of the orchestra. These were combined into three tracks associated with the centre, left and right-hand groups of players, and when reproduced through loud speakers similarly placed in the space behind the screen, gave the effect of auditory perspective obtained from listening to a real orchestra. With the help of extension speakers arranged round the auditorium, the audience were at times made to feel that they were in the midst of the players themselves.

Obviously some of the illusion would be lost if the volume range of the orchestra, normally about 70 db, were restricted to the accepted limit of 35 db for variable area recording. Accordingly, a system of automatic volume expansion was introduced and a fourth sound track was employed to

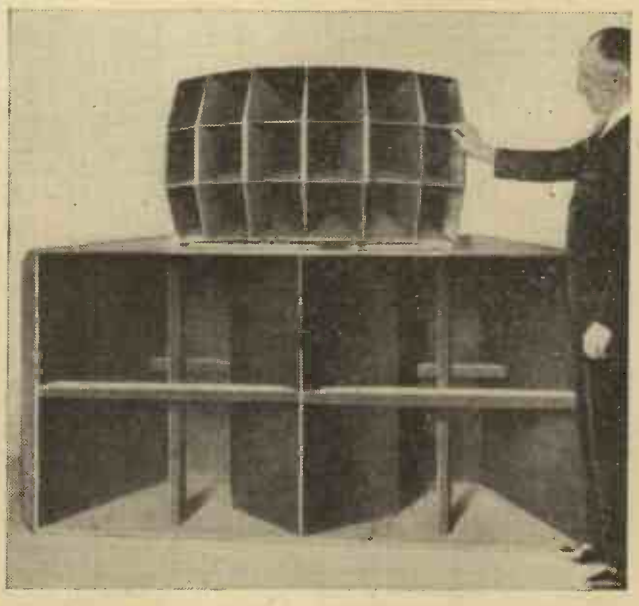


Grouping the players for stereophonic recording of the orchestra. Tentative microphone positions are indicated by the white circles.

A corner of the projection room. One of the new multi-track sound heads is to be seen on the extreme right of the picture.

control each of the three main sound tracks. The latter were of double width, thus adding 6 db to the maximum level which could be recorded, and increasing the available range to 41 db. Nevertheless, to be quite sure that film noise due to grain and scratches should be at all times completely suppressed it was decided to limit the recording range to 25 db and each sound channel was passed through a volume compression circuit which kept down maxima and brought up minima within these limits. The automatic fluctuations of bias in the compression circuits were made to modulated fixed frequencies which were recorded simultaneously as a complex tone on the fourth track. In playing back the record, filters separated the three control frequencies (250, 630 and 1,600 c/s) and after rectification the variations of amplitude were applied as control bias to the variable gain amplifiers at the head of each amplifying channel.

The four sound tracks occupy the full width of a standard 35 mm. film, which is printed quite separately from the picture. The sound film is run through a separate machine, which is synchronised with the picture projector by means of a master three-phase generator, and separate "Selsyn" motors. In the special sound head which has been developed for this purpose, a single reversible exciter lamp is provided which enables the spare filament to be brought into action merely by reversing the lamp in its socket. The light is formed into a beam one mil. wide and of a length sufficient to scan all four tracks. As the light covers the whole width of the film, the standard rotary stabiliser and solid take-off drum could not be employed, and a special scanning aperture in conjunction with a magnetically driven drum was used. The scanning light modulated after passing through the film passes to the four separate photocells housed together with their matching transformers in a compartment on what would be the front of the machine if it were a picture projector.



Two of these wide-range R.C.A. loudspeaker systems were used in each of the three stereophonic channels on the stage, the outside channels being supplemented by 22 small extension units down each side of the auditorium.

After passing through the usual operator's fader control relays, the output from the three main sound tracks goes via pre-amplifiers to the main amplifier channels. The complex control tone is amplified separately, and applied to each of the variable gain amplifiers associated with the main channels where the appropriate tone is selected by a band pass filter, rectified, smoothed and applied as bias to the amplifier. The control stage consists of two 6K7 valves in push-pull, and manual control of the expansion characteristic is available in order that the overall volume range may be adjusted to suit the size and acoustics of individual theatres.

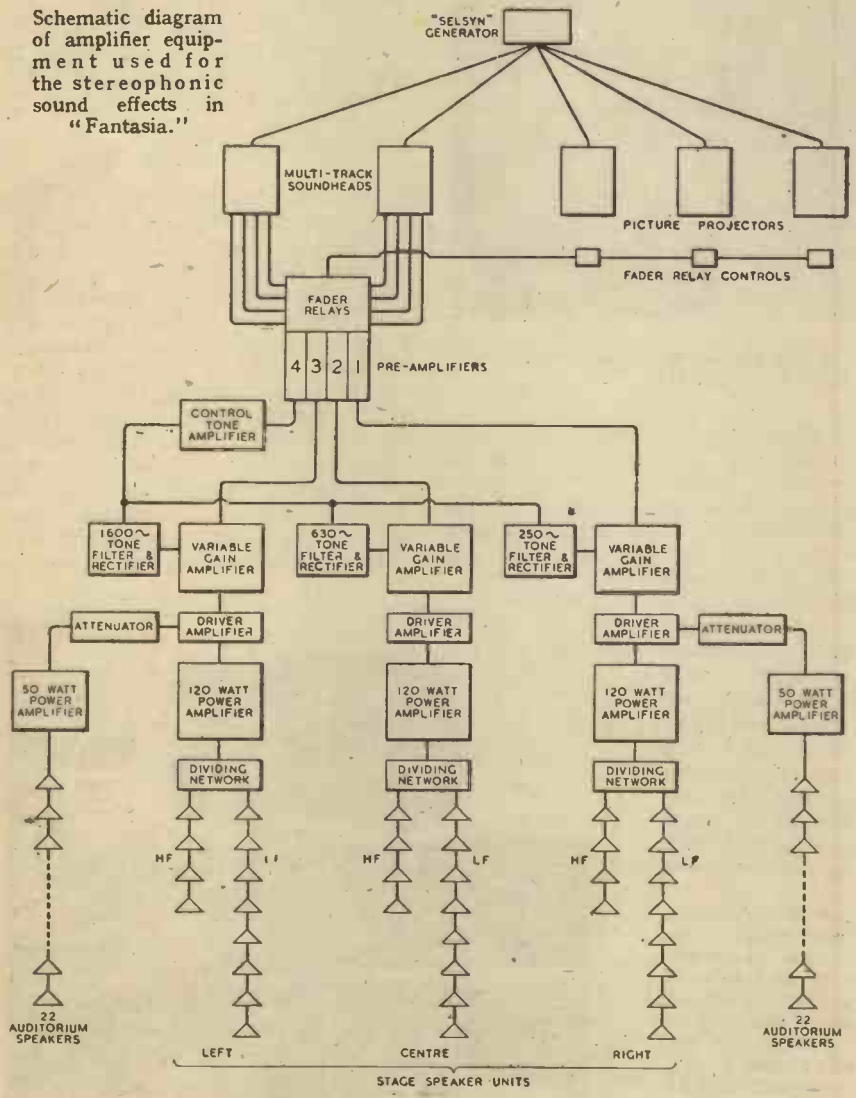
700 Watts in Reserve

The power output available from each of the main channels is 120 watts, and this is absorbed by two of the standard R.C.A. multiple loudspeaker units. These units each consist of two HF "tweeters" feeding into cellular horns and four large diaphragm speakers loaded by re-entrant horns. Separate 50-watt amplifiers taking their input through attenuator pads from each side channel feed 22 small cabinet speakers arranged along each side of the theatre. Actually, the amplifiers rated at 120 watts are each capable of delivering 200 watts with only 2 per cent. distortion, so that in practice a total of 700 watts distributed through 80 loudspeaker elements was available at the first showing of the film in New York. This power is, of course, in reserve for

"Fantasound"—
climaxes in the music, and will not always be used in the smaller theatres to which the full stereophonic equipment is taken.

In addition to the specially combined single sound track which has been printed for standard equipment, and which is the one at present shown in this country, there is another simplified version of "Fantasound" which retains the volume expansion feature, but not the stereophonic effects. This is known as "Vitasound" and is being used in the Warner Brothers theatres in the United States. In this the control track is printed in the spaces between the sprocket holes at the edge of the film, and is used to vary the strength of the 96-cycle current produced by the sprocket holes themselves. A variable gain amplifier is introduced in the chain leading to the screen loud speakers and additional house speakers are brought in to handle climaxes, the amplifier feeding them being normally biased to cut-off. This system seems very promising for screen plays where dialogue can be confined to the central loudspeakers, the side speakers being brought in only for music or special effects.

One way or another the film "Fantasia" has created a stir of the first magnitude, and while critics may wrangle over this or that aspect of the association between art and music, the significant thing from the technical point of view is that stereophonic sound is being given its first commercial trial. Leopold Stokowski, who has been a consistent supporter of all previous tests of stereophonic reproduction in America, and the R.C.A. Photophone engineers who have been responsible for the design of the apparatus, are to be congratulated on their enterprise.



Schematic diagram of amplifier equipment used for the stereophonic sound effects in "Fantasia."

"The ABC of Radio Circuits"

THERE is a very big demand at the present time, by those shortly expecting to enter one of the Services in a wireless capacity, for a book which deals with modern radio circuits and practice, so that they may furnish themselves with a useful groundwork of knowledge before actually joining up. "The ABC of Radio Circuits," by W. E. Miller, B.A. (Editor of *The Wireless and Electrical Trader*), although primarily written for recruits to broadcast receiver servicing, is also available for students in technical institutions, and also for those joining the Forces.

The author takes his readers step by step through the circuits of a modern receiver, and although a great deal of the information is also applicable to the TRF receiver, he deals mainly with the superhet, which is the type of receiver most in evidence nowadays, whether in the Services or out of them. Throughout the book, the treatment of the subject is essentially practical, and the manner in which the complicated circuit diagram of a modern superhet is sectionalised is reminiscent of the "dissected diagrams" which older readers will remember as a popular feature of *The Wireless World* many years ago. The book is equally suitable for the man who already has some knowledge of wireless matters, but desires to brush it up whether for the purpose of entering the Services or for his own edification. He will be surprised at the large amount he has forgotten, or more probably never knew. Pp. 62, 56 circuit diagrams. Published by *The Wireless Trader*, Dorset House, Stamford Street, London, S.E.1. Price 3s. 6d.; by post 3s. 9d.

"The Wireless Engineer"

AMONG the technical journals from which abstracts are included in the Abstracts and References section of the October issue of *The Wireless Engineer* are those from Japan, Russia, India, Germany, Italy, America, Canada and Switzerland. In all, over 300 articles are abstracted or referred to; some at considerable length.

The October issue of our sister journal also includes an article on the diode as rectifier and frequency-changer, the second of a series of articles on coupling circuits as band-pass filters, and the regular monthly summary of recently accepted wireless patent specifications.

Published on the first of the month, *The Wireless Engineer* is obtainable to order through newsagents, or direct from the publishers at Dorset House, Stamford Street, London, S.E.1, at 2s. 8d., including postage.

Technicians in Industry

Planning Post-war Training : Absorbing Ex-Service Men

By EDWARD E. ROSEN

(Chairman, R.M.A. Education Committee: Managing Director, Ultra Electric, Ltd.)

I HAVE been asked by the Editor to write on the technical training of wireless men in its relationship to industry; also to touch upon the probable post-war position of trained men. The last part of this request gives me some concern; anything in the nature of unsubstantiated prophecy is dangerous, and one must look back to the past for help in forming conclusions on what plans for the future may reasonably be based.

In the year 1914, a convenient date for reckoning, only 17 years had passed since the possibility of commercial radio was first demonstrated. During these 17 years, only some half a dozen concerns throughout the world were interested in the development of this new science. The personnel employed by these concerns may have numbered between three and five thousand, which number included all sea-going operators. So far as this country was concerned, two or three large stores and maybe half a dozen dealers supplied the requirements to the experimenting amateur and the curious schoolboy. Radio technical literature at that time was very scarce, and the opportunities for learning in this new science were exceedingly limited. Wireless operators in the main were trained either by the operating companies or by the very few privately owned wireless and telegraph colleges. The period of training was about eight months to a year, most of which was devoted to practising the morse code to attain the standard of speed required. Only a little time was devoted to theory which, in the main, centred around the working of a 1½-kilowatt spark transmitter plus a very simple receiver system. The total number of circuits employed in such a complete station was fewer than those contained in an average all-wave six-valve domestic broadcasting receiver in use to-day.

Engineers, and here the word must be qualified to mean men who were going to specialise either in design or construction, were recruited in the main from technical college students who had taken a two or three years' electrical engineering course of the City and Guilds standard, but which course rarely included anything but the very elementary principles of radio. The leading wireless companies during this time held special courses for recruits so trained and contracted for definite periods of service. Indeed, it would have been a serious matter for a man so trained to leave his employment in radio because the specialised knowledge could only be utilised in two, or possibly three, concerns in Great Britain.

1914 to 1918 were epoch-making years in radio. The necessities of war were responsible for an immediate demand for well-trained technical personnel on a scale hitherto not conceived. The Forces opened special training establishments for men of technical ability, and by the end of 1918 a comparatively large body of first-class technicians had been trained. It was largely this body of men who formed the nucleus of the great British radio industry as we know it to-day. Many of these men joined various manufacturing concerns either then in existence or which came into existence with the advent of broadcasting. Radio broadcasting expanded so rapidly and on such novel lines that made an amateur radio technician out of at least one person in every home.

There does not appear to have been any planning by the radio industry during the first ten years of broadcasting for the training of its technical personnel. The man behind the counter in the retail shop, whose sole technical training was derived from the numerous amateur periodicals current at that time, was the technical adviser and friend of the great listening public. It would only be fair to say that a percentage of these men, by one means or another, did so improve their technical standards as to become quite useful wireless mechanics, and did, and do to this day,

How many of those in the wireless branches of the Services will wish to remain in radio after the war, and how many of them will radio be able to absorb? This picture of R.A.F. operators in training conveys a vivid impression of the enormous intake of men into these branches, and also suggests the extent of the post-war problem of resettlement in our own particular sphere.

Technicians in Industry—

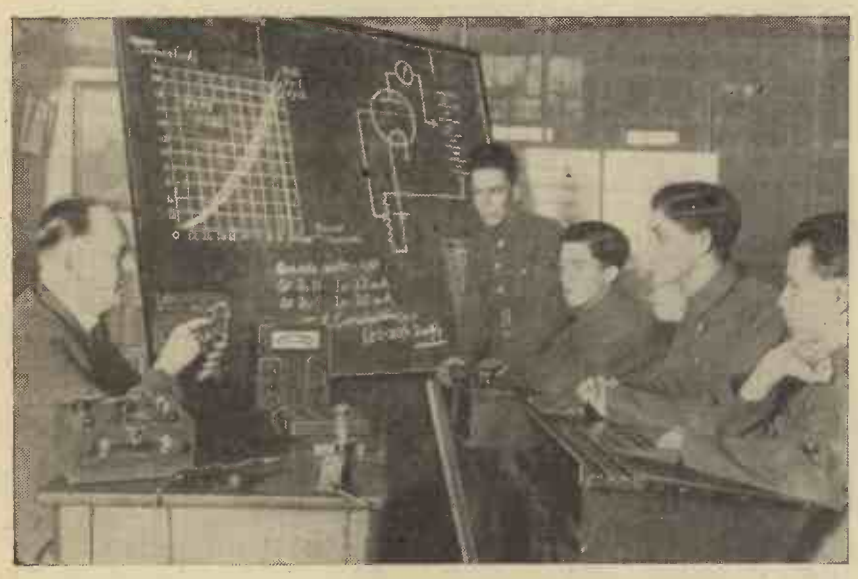
perform a very excellent service to the radio industry. The position at the outbreak of the present war was that only a small percentage of the men responsible for maintenance and repair of the nine million receivers installed in British homes were technically efficient. The advent of television, with its added complications, very soon demonstrated to the manufacturing industry the complete inadequacy of the existing facilities for providing trained personnel. The Radio Manufacturers' Association had, by co-operation with the Board of Education and various technical colleges in the country, provided courses for technical training, but the number of students who took advantage of these courses was very limited. It may well be that the salaries paid to technical personnel were not sufficiently attractive or the prospects not sufficiently encouraging for men with the right type of training to enter this field. One thing, however, was clearly established—that television expansion would be limited by the extent that first-class technical personnel were available to undertake maintenance and repair of television apparatus, which calls for a higher degree of skill than that necessary for sound broadcast receiver maintenance.

The outbreak of war in 1939 was followed by an immediate demand from the Services for large numbers of skilled wireless personnel. The age of reservation for such personnel was raised to a level where a large majority of the service men in the broadcast industry were called for duty in one of the three Services. Unfortunately, a disappointingly low percentage proved to have a sufficiently high standard of technical ability for the work for which they were required. Consequently, the Forces had to improvise extensive training schemes to provide wireless mechanics. The net result of these great war efforts in training will be that, when the war is over, a large body of men who had either come from the radio industry and received further training and most excellent experience, or men who were of the right type and who had been brought during the war to high standards of efficiency, will be available for employment in the radio industry.

It is, of course, impossible at the present time to say what proportion of men trained by the Forces can be absorbed by the radio industry at the end of the war, but it would be right to assume that high-grade technicians will be required for the research and development departments of the manufacturing industry, and that there are many at present gaining excellent experience in the Forces who should be well qualified to take up such positions in industry. The development of radio and television, in order to be of the greatest usefulness in the home, will no doubt follow the trend of the motor car, the refrigerator, and the many domestic appliances in use to-day. There will be constant striving on the part of the manufacturer to produce trouble-free apparatus requiring the minimum amount of technical service. Whatever success in this direction may be achieved, the highly technical nature of radio and television receivers will always necessitate a considerable body of trained technicians to deal with their maintenance. If the manufacturers, in the main, resolve on a policy of supplying their merchandise only through agencies properly equipped both with skilled technicians and adequate test apparatus, a very healthy set of conditions for the radio industry must obviously follow. The well-qualified technician should be the partner of the enterprising radio dealer. The advantages of such partnership must be obvious. A rough estimate of 10,000 key dealers throughout the country should, so far as this branch of radio is concerned, and assuming an average of 2½ technicians per radio dealer, find employment for some 25,000 skilled men. To this number must be added the skilled fault-finders and testers employed by the manufacturers.

The associated uses of thermionics in other industries such as the cinema, electro-medical, X-ray, must of necessity account for a further army of technicians. Now for all these purposes it is apparent that technicians of various gradings will be necessary. The highest grading for the scientific research laboratories of the State and industry will no doubt be recruited from men trained at universities, and is it too much to hope that before long a degree in electron-physics will be established? And for the first-class technicians a National Certificate for proficiency in radio, with full recognition from the whole of the industry? If these are forthcoming, an intermediate certificate for the technical assistant should be established, with the further incentive that such men may be enabled to qualify for the National Certificate.

The tendency at the present time would appear to be in the direction outlined, but undoubtedly serious thought will have to be given by the industry and the State to plan that, before men are released from the Services to return to industry, refresher courses are made available at technical colleges. Only by so doing will the two essential purposes be served—first, to provide radio technicians who know their job, and secondly, to ensure that the radio industry will progress on lines that will enable it to render the best service to the community in the better world that we hope will be established after this dreadful war.



In addition to the large number of men who have entered the wireless branches of the Forces, many youths are receiving radio training in the Air Training Corps. These members of No. 1220 Squadron (March and District) are learning about valves.

Ceramic High-Frequency Insulators

Recent Developments Reviewed : Electrical and Mechanical Design Considerations

By ERNST ROSENTHAL, Dr.Ing., A.M.I.E.E.
and
J. E. NICKLESS, A.M.I.E.E.
(Bullers, Ltd.)

Cossor valve with ceramic base and, on right, a coil (Bullers) of which the conductor consists of a silver coating deposited on a ceramic former ; the inductance value can be adjusted within narrow limits by compressing the coil.

EVERY insulator coming within the influence of an electrical alternating field consumes a certain amount of electrical energy and transforms it into heat, and losses occur.[1] It follows from the equation given in the footnote that the energy lost in an insulator increases with the square of the voltage and with the frequency; it is, furthermore, dependent on the loss angle or power factor of the insulating material in question. This power factor has a certain value in the case of each material and in many cases increases with increasing frequency and with increasing temperature. It can, therefore, be seen how very important is the influence of the frequency on the energy lost in insulating materials. If the power factor of the insulator increases with increasing frequency, it is right to say that energy loss increases with the square of the voltage and the square of the frequency.

To give a practical example: A high-tension bushing manufactured of porcelain (the loss factor of which is about 100×10^{4} at low frequencies) and having a capacity of 5 $\mu\mu$F would, at a voltage of 10 kV at 50 cycles consume about 1.5 milliwatt. At 50×10^{6} cycles it would, however, consume 1.5 kW, which loss would very quickly increase owing to the heat caused by that heavy consumption of energy—energy that is in this case entirely wasted.

It is quite obvious that such a bushing would form a very weak point in a high-tension high-frequency circuit, because the insulating material would soon break down owing to the heat developed by the high power factor of the insulating material. A substance possessing a sufficiently low power factor which, at the same time should be independent of the frequency and of the temperature, should be used instead to keep the high-frequency losses of the bushing down to approximately the same level as the bushing would introduce at low frequencies.

It has to be borne in mind that for low frequencies porcelain is a highly satisfactory and useful insulating material and suitable at these frequencies for the most severe working conditions. But for high frequencies it should, owing to its high power factor, be replaced by other materials having a low power factor and the same favourable, or if possible even better, mechanical characteristics, because the power factor is not the only material constant that has to do with the absorption of power. Since air has a smaller power factor than even the best solid insulating material, it is very often essential to use insulators of the smallest possible size. This requirement makes good mechanical characteristics of the insulating material of decisive importance.

Recent Improvements

When considering the example given for porcelain bushings above, it should be furthermore borne in mind that porcelain has, at low and high frequencies, a much lower power factor than most of the insulating materials used in high-frequency oscillatory circuits not many years ago.

These explanations illustrate the importance of the very great improvements which have been achieved by the ceramic industry and science. Special high-frequency ceramics which meet all the requirements called for by high-frequency technique have now been developed.

It has been shown that a low power factor is very important for every kind of insulating material used in high-frequency circuits. We have also seen that, if the purpose of the insulator is to support or otherwise space the electrical conductors, the dielectric constant has to be kept low because a higher dielectric constant would result in a higher capacity of the insulator and this would introduce higher dielectric losses. But if, on the other hand, the insulating material forms the dielectric of a condenser, the fact that a higher dielectric constant results in an increased capacity of the condenser may be made use of, because it makes it possible to keep the dimensions of the condenser small. For this purpose special ceramic materials have been developed which combine a high dielectric constant with a low power factor.

Temperature Effects

Most of the condensers hitherto used and most of the insulators which, owing to the fact that they are in the neighbourhood of strong electrical fields, form a kind of condenser, possess a dielectric constant (permittivity) which increases with increasing temperature, causing their capacity to increase and resulting in a positive temperature drift of the whole oscillatory circuit. To compensate for this drift, dielectric material with negative temperature coefficient of its dielectric constant (permittivity) was looked for and this requirement was met by the development of new ceramic insulating materials possessing a negative temperature coefficient of the dielectric constant.

This type of material is now used for the manufacture of condensers which make it possible to compensate the positive temperature drift of the oscillatory circuit.

[1] When the lost energy (N) is only a small proportion of the total energy, it is given nearly enough by the equation

$$N = V^{2} 2\pi f C \tan\delta$$

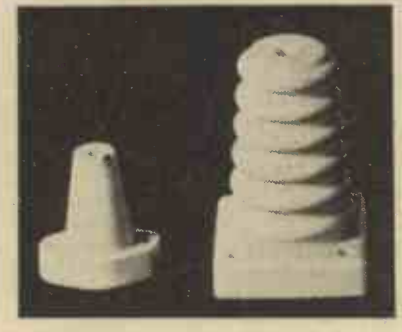
where V is the voltage, f the frequency, C the capacity $\tan\delta$ the tangent of the loss angle or the power factor of the insulating material. The capacity C is determined by the dielectric constant and shape of the insulator and electrodes. Both are constants, the former being a material constant and the latter a constant of the insulator design. The dielectric constant of most insulating materials used for radio frequencies, with the exception of some ceramic condenser materials referred to later in this article, is between 5 and 10.

Ceramic High-Frequency Insulators—

In other cases it may be of advantage to use ceramic insulating materials which do not change their volume with increasing and decreasing temperatures. Very small changes in the length of an insulator may, for instance, change the capacity conditions or a small change in the diameter or the length of a coil may change its inductance. To avoid such alterations the use of a ceramic material which has a very small heat expansion coefficient is of special advantage.

The design and manufacture of high-frequency and high-power valves confronts the manufacturer of insulating material with special problems. According to its position in the interior of the valve the power factor may be of greater or less importance; or, according to the heat developed in the neighbourhood of the interior insulator, the ohmic resistance at high temperatures and the power factor at high temperatures may be more important. Under normal conditions the insulating material must not possess any porosity because the absorption of humidity would completely upset its insulating qualities. But at the high temperatures in the interior of a valve the conditions are different, and for these special purposes materials have been developed possessing a certain porosity which allows all the occluded gas particles to be removed before the final sealing up of the heated valve.

Stand-off ceramic insulators for medium and high voltages.



It follows from these statements that various different insulating materials are required having quite different electrical and physical characteristics. The following five types meet the different requirements called for in high-frequency technique:—

1. Insulating material with a low power factor, low dielectric constant, and high mechanical strength for general use as insulators and insulating or spacing parts of components like coil-formers, bases of trimmer condensers and mica condensers, waverange switches, crystal holders and plates for air tuning condensers, variometers, spacers for co-axial cables, etc., etc.

2. Insulating materials having a low power factor and high dielectric constant for the manufacture of high-frequency condensers, low and high tension.

3. Insulating materials with high dielectric constant, low power factor, and a negative temperature dependence of the dielectric constant, the negative temperature coefficient being graded so that high, medium and low negative temperature coefficient of the dielectric constant may be available.

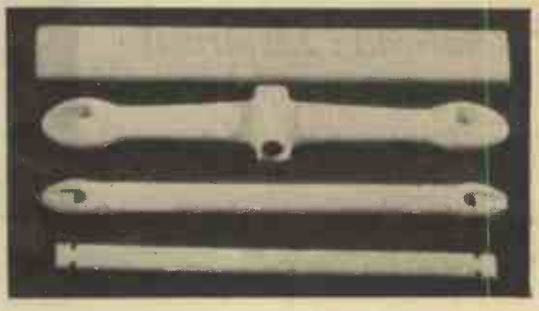
4. Insulating material possessing low temperature coefficient of expansion, low dielectric constant, and a low power factor.

5. Insulating material possessing at high temperatures low power factor and high ohmic resistance which do not release air *in vacuo* at high temperatures.

After having set out the main physical and dielectric characteristics required by short-wave technique, we will now briefly describe the various new ceramic materials which possess these required characteristics.

This task is in each case fulfilled by manufacturing substances containing the various crystals which possess the physical characteristics required, and which impart their properties to the ceramic insulating material. All these crystals do not occur in any quantities worth mentioning in nature, but are produced by mixing materials, which contain certain constituents of the desired crystals, and the formation of which is then achieved by firing the mixture at high temperatures.

The material that we have placed in Class 1 is characterised by the crystal Clinoenstatite, which is formed by firing under suitable conditions of the mineral talcum, steatite or soapstone.



Various types of aerial insulator.

These minerals, identical in chemical composition but different in crystalline structure, are hydrous magnesium silicates of the formula $3MgO4SiO_2 1H_2O$. These types of bodies were formerly called steatite bodies, but since this word has been used for all kinds of ceramic materials containing the above-mentioned magnesium silicates, it is more clear to denominate these vitrified bodies after the crystal Clinoenstatite ($MgOSiO_2$), which is formed by the dissociation of talc, or soapstone, at high temperatures. The desired electrical properties are entirely a function of the degree of crystallisation, and it has been proved that as more of this crystal is formed and the more homogeneous its structure, the more favourable are the dielectric properties.

Raw Materials

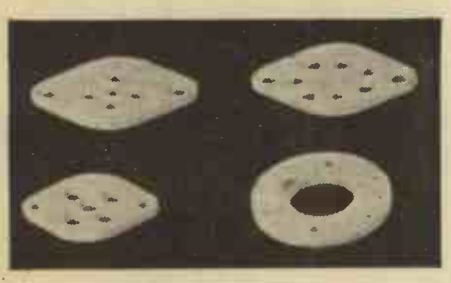
Since this type of insulating material is the most widely used in high-frequency technique, a few words may be said about its composition and manufacture. For making insulators of the Clinoenstatite type talcum, soapstone or steatite are finely powdered and carefully mixed with some clay and certain fluxes. Despite the fact that these fluxes constitute only a very small portion of the body they are the determining factor for the properties of the finished article, and by varying these fluxes the ceramic engineer can produce specific properties in the finished body. The mixture of talc, clay and fluxes is plastic enough to be pressed by steel dies into the desired shapes. By adding some water to the dry mixture, higher plasticity is obtained, which makes it possible to extrude the body into tubular shapes or rods through extrusion presses. After drying, the

pressed or extruded articles are hard enough to be machined like metal parts, and it is possible at this stage to drill holes or make other modifications which could not be obtained by the pressing process.

The firing, which takes place at very high temperatures, changes the relatively soft article into a stone-like and well-vitrified mass.

Commercial examples of the Clinoenstatite type of insulation material produced in this country bear the trade names of Frequelex (Bullers) and Frequentite (Steatite and Porcelain Products).

Ceramic insulating material in Class 2, with a low power factor and high dielectric constant and high permittivity, is made by grinding and suitably preparing the mineral rutile (TiO_2). The main characteristic of rutile is the very high dielectric constant, and it imparts this characteristic to ceramic bodies. Only a very small percentage of clay or bentonite is added to make this material workable. A very high dielectric permittivity is only of advantage if used as a dielectric for condensers. Since only a very slight percentage of plastic clay can be added to the rutile, these types of bodies are not very plastic and can only be worked into simple shapes. High-frequency condensers for low working voltages have the shape of tubes, discs or caps, and even for higher tension no complicated or intricate forms are required. Therefore, this type of material is now widely used for the manufacture of



Ceramic valve holders.

condensers. Of special importance is the fact that the temperature coefficient of the dielectric is negative, and this fact enables condensers with rutile dielectrics to compensate for the positive temperature drift of the oscillatory circuit.

If the total amount of the positive frequency drift present in an oscillatory circuit has been determined and the change of capacity caused by temperature variation measured, it is easy to calculate the capacity necessary for compensation and the temperature coefficient of the permittivity which this compensating capacitor should possess, and it is so possible without drastic changes in the design of short-wave apparatus to obtain independence of its frequency from temperature.

Faradex and Permalex, produced respectively by Steatite and Porcelain Products and Bullers, are commercial examples of British rutile insulators.

The capacity change per degree Centigrade of this type of body is minus 6.5×10^4. For many purposes a smaller capacity change per degree Centigrade is desirable, and for cases where such kinds of dielectrics are required, the insulating materials of Class 3 have been developed. These are also used primarily for the manufacture of condensers, the temperature coefficient of its permittivity ranging between minus 6.5×10^4 and zero. This type of material is characterised by the formation of magnesium titanates. There exist various magnesium titanates having a different ratio of magnesium oxide and titanium oxide, all possessing an extremely low power factor and a graded coefficient of the temperature dependence of the permittivity according to the composition and structure of the crystals.

Tempalex and Tempradex are examples of British-made insulating material in the magnesium titanate class. The first is produced by Bullers and the second by Steatite and Porcelain Products.

Class 4 : Cordierite

The insulating materials in Class 4 are characterised by the formation of the crystal Cordierite, which has the formula $2MgO2Al_2O_35SiO_2$. This mineral, which does not occur in nature, has an extremely small thermal expansion and imparts this property to ceramic bodies which are manufactured by mixing talcum, clay and alumina in certain proportions. Since a considerable percentage consists of plastic material, it is possible to manufacture insulators of the various shapes described for Class 1.

These Cordierite bodies are manufactured for high-frequency components by Bullers, and in the United States by the Lava Corporation.

Ribbed and grooved coil formers.

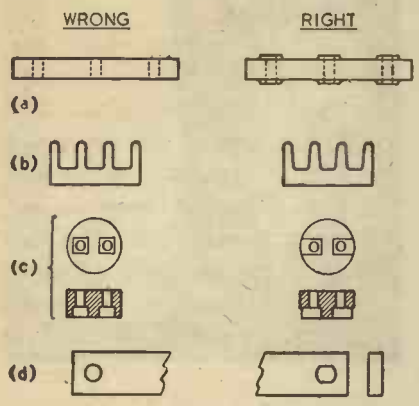
The insulating materials in Class 5, specially designed for the manufacture of interior valve supports, have various compositions according to the special purpose for which they have been developed. The most universally suitable bodies for valve spacers are talcum bodies containing no flux and possessing low power factor and high ohmic resistance at high temperatures.

The principal characteristics, as compared with porcelain, of the ceramic insulators in Classes 1-4 are summarised in the accompanying table.

It has been mentioned above that the various types of high-frequency ceramics are shaped in a plastic state and that they owe their physical properties to the crystals which are being formed during the firing process at high temperatures. The consequence of these facts is that the fired articles leave the ovens smaller than when they were originally shaped, and this shrinkage amounts to 10 per cent

	Clinoenstatite (Class 1)	Rutile (Class 2)	Magnesium Titanate (Class 3)	Cordierite (Class 4)	Porcelain
Power factor at 10 Mc/s × 10^4 ...	3–6	2.7–8	0.7	40–70	70–120
Dielectric constant (permittivity)	5.5–6.5	40–80	14–16	5.5	5.0–6.5
Capacity change per °C. × 10^{-4} ...	+1.4–+1.6	−6.5 – −8.5	+0.5– −0.7	+1.5	+1.5–+2.5
Tensile strength lb./in.²	6500–8500	6000–8500	6000–8500	4200	4200–4500
Compressive strength lb./in.² ...	65 000–100 000	40 000–80 000	40 000–80 000	50 000	40 000–60 000
Linear Coefficient of Expansion ×10^{-6}	6.3–8.5	7–8	6.2	1.1–1.8	3.5–4.8

Ceramic High-Frequency Insulators—to 18 per cent. of the original size. This is due first of all to the fact that plastic materials like clay or talcum are being used to give the required shape, and these plastic materials contain water in various states. During the drying process the moisture evaporates, causing some shrinkage.



Some of the points to which attention should be paid in the design of ceramic insulators. Adoption of the correct practice makes for economical production. (a) It is difficult to ensure that strips of considerable length shall be perfectly flat, but in many cases the effect of any deviation can economically be overcome by providing holes with bosses, the faces of which can easily be ground dead true. (b) Narrow fins and sharp junctions with the main body result in drying cracks and heavy manufacturing losses. Sturdy fins and joints to the main body with generous radii and slightly sloping sides represent the right design. (c) Closed square slots for registering bolt heads, etc., should not be placed close to the periphery of the article because the thin wall of porcelain is a source of weakness. Rectangular slots which obviate the need for side walls are just as effective. (d) On articles where screws, bolts or plugs are fitted through plain holes in an insulator, it is necessary to compensate for the variations and shrinkage of all ceramic materials. An elongation of these holes will compensate for such variations.

During the firing process further evaporation takes place, causing further shrinkage and leaving air pockets which, when the material gets soft at higher temperatures, are closed, and this obviously results in further contraction. This shrinkage is not exactly equal and does not amount to the same percentage in the various directions. As a result certain tolerances in the dimensions have to be allowed to the manufacturer, and when designing insulating parts the designer has to take these facts into consideration. If very great accuracy is required, the ceramic articles can be machined either after the drying or even after the firing, but the latter process is expensive and its application should be reduced to the minimum possible extent. Since the designers of high-frequency apparatus are seldom specialists in the manufacture of ceramic materials, a close collaboration between the designers of high-frequency apparatus and the manufacturers of ceramic parts is very essential. Some indication of the kind of details to which the consideration of the designer of ceramic parts should be given will be gleaned from the accompanying drawing. Attention to matters of this sort increases the efficiency of production and also keeps down cost.

In concluding this article the authors wish to acknowledge the assistance received from Messrs. Bullers, Ltd., and to express their thanks for permitting publication of the photographs.

A.R.P. and All That

A Wireless Warning System from the U.S.A.

AN interesting method of giving A.R.P. and other emergency warnings by wireless at any hour of the day and night has recently been developed in the U.S.A. by RCA engineers, and demonstrated in New York and elsewhere.

It functions in a very simple manner. When it is desired to send out an emergency message such as an air-raid warning, a warning of floods, or anything of a similar nature, from a broadcasting station, the announcer plugs into the microphone circuit an oscillator unit which modulates the carrier wave of the broadcasting station at a frequency of twenty-four cycles-per-second, or any other convenient value.

This is picked up by a special fixed-tune three-valve receiver which must be left constantly switched on ready to receive this special signal. The signal is used to operate a relay which sounds an electric bell and switches on a light in order to attract attention. At the same time the loudspeaker attached to the emergency set is switched on so that all is ready for the special emergency announcement to be made.

When it is desired to reverse all these effects, i.e., to disconnect the loudspeaker, and re-set the receiver to the "stand-by" position, the announcer at the broadcasting station presses a switch which causes the carrier of the station to be modulated at a frequency of 36 c/s or other chosen frequency.

One of the advantages claimed for this system is that it can be made quite independent of the electric power supply mains which might be cut off in an emergency. The special receiver which, as already mentioned, is left switched on all the time to receive the warning signal, can be operated from batteries to make it quite independent of mains failure.

One cannot help feeling, however, that the system has many disadvantages, as even though special low consumption valves can be used in order to render battery life considerable, they will not be everlasting, and by the general cussedness of things they will probably run down shortly before an emergency happens. An even greater disadvantage is the apparent impossibility of localising the warnings over a restricted area, and we have yet to be convinced that our own authorities were wrong in adopting the system of warnings which has stood up so well to the test of war.

The Wireless Industry

STRATTON & CO., LTD., makers of "Eddystone" components, are now established at Alvechurch Road, West Heath, Birmingham, 31, and have just issued a loose-leaf technical handbook with data sheets of the lines which are now available.

◈ ◈ ◈

The range of nuts and fastenings sold by Simmonds Aerocessories, Ltd., under the name of "Speed Nuts" will in future be known as "Spear Nuts."

◈ ◈ ◈

Multicore Solders, Ltd., Bush House, London, W.C.2, have now produced a pure tin solder with three cores of "Ersin" flux in gauges from 10 to 22 SWG for work requiring a lead-free solder.

◈ ◈ ◈

The spectrographic determination of impurities in lead-tin solders is dealt with in Publication No. 105 issued by the Tin Research Institute, Fraser Road, Greenford, Middlesex.

◈ ◈ ◈

Leaflets describing small coil-winding machines, both hand and power driven, are issued by Frank Whitelegg, 90, Robin Hood Lane, Sutton, Surrey.

Planning Post-War Broadcasting

Should Long and Medium Waves be Scrapped?

By E. P. BUTT

An article in last month's issue showed some of the difficulties in the way of effective and equitable allocation and use of channels for European broadcasting on medium and long waves. The author of the present article suggests the total abandonment of these wavelengths, and describes a scheme for using short and ultra-short waves in their place

A SERVING soldier in the Middle East, it may well be argued, is hardly a good judge of the trend in the development of radio at home. Yet distance gives a detachment to the onlooker which is sometimes denied to those on the spot. So, it seems to me, that the ideas of one, somewhat removed from the scene of events, but profoundly affected by them, may well be of value to those at home.

One of the first, and to my mind most significant, effects of the war on radio was the demise of broadcasting on the long-wave bands. Long-wave broadcasting was the cradle of modern radio, but I, for one, hope that those pre-war giants of the ether which infested the band will never reopen and that these wavelengths will be more usefully employed by commercial stations. I also hope that this trend of cutting out redundant wave-bands will continue in a downward direction.

"Nation Shall Speak . . ."

Another very striking feature of wartime radio is the enormous importance and public interest in short-wave broadcasting. The short-wave band appears to be rapidly superseding the medium-wave band as the medium for expressing the national point of view, and as such has attracted a large portion of the radio public in its search for news. What, then, is the use of the medium-wave band? The obvious answer to this query is that the medium-wave band provided the main channel for distributing programmes primarily meant for home consumption. This function it fills incompletely owing to its international character, which has imposed upon the nations a necessary limitation in the number of wavelengths available to each country with a consequent deterioration in service. In spite of this, however, interference is rife over the whole band. The only way out of this impasse, in my opinion, lies in the full utilisation of the 5-10-metre band.

The limitations of the ultra-short-wave band are obvious enough. Yet its principal limitation, its small and well-defined service area for each station, could be a tremendous advantage. The whole country could be covered, quite cheaply, by using a comparatively large number of stations of low power on three wavelengths. The stations could be so arranged that no two on the same wavelength were adjacent. In this manner the whole country could be given a good local service without considering what was happening at Riga or Sofia. The international role of broadcast could be adequately served by the short-wave band. In fact, this state of affairs already exists. This scheme would eliminate the necessity of maintaining costly stations on the medium-wave band, although until other nations had adopted a similar plan our national point of view would have to be maintained on this band.

The suggestion that the ultra-short-wave band be used for the local service brings into prominence the future of television, since the two services would then be more closely linked. There are two main points which need to be borne in mind here. First, that whilst television has a great appeal in thickly populated districts it offers its greatest advantages in more lightly peopled areas where the competition of other amusements is not so strongly felt. Secondly, that it seems unlikely that an all-day service will ever be economic. These conclusions stress the need for a national coverage for television, the sound transmitters providing a useful alternative programme, especially outside television hours.

Home Service Plan

My proposal, then, is to cover the whole country with a network of ultra-short - wave transmitters, built in groups of three There would also be twin transmitters for television and another transmitter for sound radio, with the television sound transmitter acting as a regional alternative station. This would utilise nine wavelengths, the stations being arranged in such a manner that those on the same frequency were geographically well separated. It would probably also be necessary to build some single stations in very remote areas, giving the sound programme only in much the same way as is done now on the medium-wave band.

The advantages accruing from this scheme would be numerous The principal advantages are that foreign stations could not interfere with the local programme and that high-quality reproduction would be more easily and cheaply achieved. Practically the whole of the medium-wave band could be handed over to commercial users, if other nations followed our lead, thus giving a certain amount of relief to the short-wave bands.

Scope for Designers

The industry would also reap considerable benefits, as a very cheap local station set, giving excellent quality results, would be comparatively easy to produce, and the more expensive sets would only need to cover the short-wave and ultra-short-wave bands. This would give designers and technicians far greater scope than at present in the design of sets and free them from certain encumbrances (and may I say fetishes?) imposed on them by the chaotic condition of the medium-wave band.

Obviously the transition to this scheme would have to be gradual, although the war, and in particular enemy aircraft, may force the issue. After the war it seems more than likely that the whole of our broadcasting system will badly need an overhaul. Let us hope that those in high places, not only in the B.B.C. and in the industry, will have the vision and initiative to replan our broadcasting services boldly.

THE WORLD OF WIRELESS

AMATEUR FREQUENCIES

80-metre Band for U.S. National Defence

THERE is under way in the United States a vast plan for the training of thousands of pilots at some 40 new flying schools, each of which will maintain from 25 to 50 training 'planes. According to *QST*, these schools are planned to produce an annual output of 30,000 American and 7,000 British pilots. For the instruction of pilots at this rate a new technique in training has been introduced.

When a student has finished his basic training his instruction in solo flying will be undertaken with the aid of two-way radio telephony between his 'plane and the instructor's or a ground station.

In view of the existing congestion throughout the spectrum and the desire to cause the least possible inconvenience to existing services, it was recently announced by the U.S. Federal Communications Commission that amateur operation within the continental United States on the frequencies between 3,650 and 3,950 kc/s, which are normally assigned exclusively to amateurs, would be temporarily restricted.

It is understood that the transmitters on the 'planes have an output of only four or five watts, and the ground stations 50 watts. A reliable service area of over 25 miles is provided.

LICENSED LISTENERS IN AMERICA

FM Experiment in New York

IT has been estimated that ten per cent. of the New York population is prepared to pay $2.50 a month to receive high-fidelity non-commercial programmes radiated by the Musak Corporation from its new 1-kW frequency-modulation station. To restrict reception to subscribers, an interfering signal, which can only be tuned out with the receiver supplied, is transmitted.

Musak has for some years been applying advertisement-free programmes by line to hotels, restaurants and flats. According to *Broadcasting*, Musak, in a statement to the F.C.C. when applying for permission to construct the new station, stated that the purpose of the experiment is to determine whether the public or a sufficiently large portion of the public would prefer to obtain programmes by direct payment for the service.

RADIO DIPLOMA "RAMP"

Manchester I.R.E. Case

FOUND guilty on a series of charges of "unlawfully and knowingly by certain false pretences" obtaining various sums of money paid as fees to the Institution of Radio Engineers and its successor, the Royal Institution of Radio Engineers, the secretary, R. W. N. Spencer, was recently sentenced to twelve months' imprisonment by the Salford Stipendiary.

Evidence was brought that Spencer had conducted a bogus business at 393-395, Bury New Road, Broughton, Lancs, and that he personally collected many hundreds of subscriptions from persons who were under the mistaken belief that the organisation was a genuine one exercising some influence in the wireless industry and among radio engineers.

The fees payable were £3 3s. for associate membership, open to service engineers up to 22 years of age; £5 5s. for membership (managers up to 28); and £10 10s. for fellowship (proprietors and directors over 35). The benefits set forth in the circular were a diploma, referring to "theory and practice in radio and television engineering," a printing block of the I.R.E. emblem, a cigarette case with the emblem on it, lectures and books.

It was claimed in evidence that there never was a lecture or examination, and that the "registrar" who signed some of the diplomas was a 17-year-old typist. Having later registered his business as the Royal Institution of Radio Engineers, Spencer circularised members inducing them to pay one or two guineas for new diplomas from the "Royal I.R.E., incorporating the I.R.E."

In his summing up the Salford Stipendiary (Mr. F. Bancroft Turner) said: "I have not the slightest hesitation in describing this institution as a ramp. It merely existed for the purpose of purporting to sell the use of letters after a man's name."

The secretary of the British Institution of Radio Engineers asks us to point out that it has never in any way been associated with the Manchester concern.

CIVILIAN TECHNICAL CORPS

THE first contingent of some 50 American volunteers for the Civilian Technical Corps were welcomed to Britain by Air Marshal Sir Philip Joubert, A.O.C., Coastal Command, early in October. In welcoming the technicians, many of whom will be engaged on radiolocation, Sir Philip said: "Those now engaged on radiolocation can look forward to peace, for they will then be 'in' on something likely to be one of the biggest single factors in improving safety in the air and at sea."

It will be remembered that the C.T.C., who will wear blue-grey uniform of the R.A.F. pattern with a flat-topped field service cap bearing the Corps badge, is a body of civilian craftsmen recruited from America for the maintenance and repair of Service technical equipment. They receive civilian rates of pay and undertake to serve as non-combatants for three years or the duration of the war, whichever is the less.

The Secretary of State for Air recently appointed Mr. Donald Gill as Commandant of the Corps.

DAMAGE TO IMPOUNDED AMATEUR APPARATUS

P.M.G. Not Responsible

CONTRARY to general expectations, the G.P.O. recently stated that the Postmaster-General "is under no liability for damage by enemy action or other causes beyond his control" to transmitters' apparatus now in the hands of the G.P.O.; "he is merely a bailee of the property."

It is understood from the Insurance and Companies Department of the Board of Trade that the apparatus falls within Part 2 of the War Damage Act, 1941, and would be insurable either under the business or the private chattels scheme. Two explanatory memoranda, BS4 and PCS5, can be obtained from the Board of Trade, Romney House East, Tufton Street, London, S.W.1, or from most fire insurance companies.

The G.P.O. is notifying owners of apparatus of its present whereabouts and if it is damaged, so that those who desire may inform their insurance company.

Owners of impounded apparatus are asked to notify the Engineer-in-Chief, G.P.O. Radio Branch (W2/1), Harrogate, Yorkshire, of any change of address.

INSTRUMENTS WANTED

Lord Hankey's Appeal

LORD HANKEY, H.M. Paymaster-General, at the recent Radio Manufacturers' Association luncheon appealed to radio manufacturers to release every radio technician they possibly can who is under the age of reservation for one of the three Services in a radio capacity.

He referred to the shortage of instruments for the training of young people in technical colleges and universities owing to the heavy demands of the Services. The instruments most urgently needed are multi-range AC and DC meters, especially the Model 7 and Model 40 Avometer and Avominor.

Readers who have spare instruments are asked to send details to Mr. R. P. Browne, Secretary of the Radio Manufacturers' Association, 59, Russell Square, London, W.C.1, stating type, approximate age and condition, price desired (if not offered as a gift) and their full name and address. The apparatus should not be sent.

PRESS AND RADIO

Journalists and the B.B.C.

THE view recently expressed by Mr. J. H. Brebner, Director of the News Division of the Ministry of Information, that newspapers and radio do not clash is not shared by Mr. W. R. Willis, president of the Institute of Journalists, who urges that the B.B.C.'s early morning news bulletins should be eliminated, as they "work prejudicially to the Press by taking off the cream of the morning papers."

In Mr. Willis's view, "the B.B.C. is creating, to an alarming extent, a completely uninstructed and docile mass opinion." This view has been criticised by correspondents to the Press. Mr. Arthur Mann, a governor of the B B.C., writing in the *Yorkshire Post*, submits that the Press and the B.B.C. play a complementary rôle in the service of democracy, and that "the intelligent interest in affairs encouraged by the B.B.C. causes the listener to turn with greater avidity to his newspaper for fuller information and editorial opinion."

It is pertinent to note the situation in America, where, as a result of a recent survey conducted by the director of the magazine *Fortune*, it is revealed that broadcasting is the source from which the majority get their news. From a census of over 5,000 persons, providing a good cross-section of public opinion, it was shown that 39 per cent. rely upon broadcasting for their news and 31 per cent. upon newspapers, while 26 per cent. do not favour one more than the other.

TELEVISION SETS

Output in America

WITH insufficient materials for making ordinary broadcast receivers, owing to the demands of National Defence, manufacturers in America are not planning to start production of television receivers on a very large scale.

New York's three thousand odd television receivers, which were built for the reception of the early transmissions, are being altered to conform to the new standards now in use. In addition, RCA and DuMont each have about five hundred sets at their factories, which are also being converted. It will therefore appear that New York's television receivers will not exceed five thousand for some time to come.

Despite the fact that since July 1st New Yorkers have a choice of programmes from competing stations, television is, for the present, likely to have but a small audience.

M.o.I. AND B.B.C.

RECENT Parliamentary debates have clarified the relationships between the B.B.C. and the Government. It has been made clear that the Ministry of Information now controls all news broadcasts—Home, Empire and to non-enemy-occupied countries. Broadcasting to the enemy and to countries under his control is directed by the Political Warfare Executive (of which the Minister of Information is a member). Non-political, cultural and entertainment programmes are still controlled by the B.B.C. Governors.

WOMEN WIRELESS OPERATORS

IT may not generally be known that women holders of the Postmaster-General's Special Certificate of Proficiency in Radio-telegraphy are eligible for enlistment as wireless operators in the Women's Royal Naval Service and the Women's Auxiliary Air Force. They will be entitled to a refund of tuition fees and travelling expenses, up to an inclusive maximum of £25. The age limit for candidates, who must satisfy the required medical standards of fitness, are 17½-43.

DEATH OF A PIONEER

IT is with regret that we record the death, at the age of 64, of Mr. Francis Thomas Ogilvie, one of the very early members of the Marconi Company's staff. Mr. Ogilvie later transferred to the Post Office service, and, at the time of his retirement some four years ago, was in charge of the North Foreland station, GNF. He had previously served at Crookhaven, Malin Head, the Lizard, Niton and Cullercoats. He was one of the pioneer wireless operators on the Atlantic routes with the Nord-deutscher Lloyd Company.

FROM ALL QUARTERS

Anti-interference Regulation

A REGULATION on the limitation of disturbance caused by low-powered electrical apparatus was drafted at a recent meeting of a committee of the Swiss Association of Electricians. It is learned from the Bulletin of the International Broadcasting Union that it was proposed by the Association "Pro Radio" that the limit of the interference be set at 0.5 mV per metre, but 1 mV/m was finally agreed upon.

I.E.E. Meetings

THE Council of the Institution of Electrical Engineers has decided to hold monthly meetings of the Institution and of the various sections in London during the first half of the forthcoming session at 4 p.m. Sir Noel Ashbridge's inaugural address as president will be delivered on Thursday, October 23rd. Mr. H. Bishop's inaugural address as chairman of the Wireless Section will be delivered on Wednesday, November 5th.

U.S. Army and Naval Stations

IN order to facilitate the identification of the control station of the United States Army Amateur System network, the call sign has been changed from W3XCL to W3USA. The new control station for the naval amateur activities will be given the call sign W3USN.

B.B.C. Short-wave News

THE transmission of news in English in the B.B.C.'s European and World Services will be radiated at the following times (BST) and on the following wavelengths when this issue is published:—

0200: 31.32, 31.25, 25.53.
0300: 49.10, 31.32, 31.25, 25.53.
0530: 49.10, 31.32, 31.25, 25.53.
0715: 31.55, 25.53, 19.82, 19.66, 19.60, 16.86.
0900: 49.59*, 41.49*, 31.55, 30.96*, 25.53, 25.38*, 25.29*, 19.82, 19.66, 19.60, 16.86, 16.84.
1200: 25.53, 19.82, 16.84, 16.77, 16.64, 13.97.
1400: 25.53, 19.82, 16.84, 16.77, 16.64, 13.97.
1430: 49.59*, 41.49*, 25.38*, 25.29*.
1700: 31.75, 25.53, 19.82, 19.66, 16.84, 16.77.
1900: 31.55, 25.53, 19.82, 19.66, 16.84.
2145: 31.25, 25.53, 19.82, 19.60.
2300: 49.59*, 41.96*, 41.49*.
2345: 31.32, 31.25, 25.53.

Wavelengths marked with an asterisk are used in the European Service.

I.P.A.E.

MR. N. PARTRIDGE, chairman of the Institute of Public Address Engineers, reported at the recent annual general meeting that the membership had shown an increase, and that the financial position of the institute had improved. Although the peacetime uses of PA had been practically eliminated, it was playing its part in a variety of ways in the war effort. At a meeting of the Council

The World of Wireless—

following the general meeting, Mr. G. A. V. Sowter was elected chairman for the ensuing year. Mr. Partridge, who has been chairman for three years, will continue on the Council as vice-chairman. Mr. A. T. Moyle is honorary treasurer, and Mr. H. Curtis acting secretary.

School Broadcasting

THE Central Council for School Broadcasting recently stated that with the opening of the school broadcasting year 2,500 more schools are now listening than a year ago. The total number of schools registered in England and Wales is just over 10,000, with a further 1,000 in Scotland, registered with the Scottish Council. Schools that are finding it difficult to obtain HT batteries are advised to write to the Central or Scottish Council.

U.S. Radio Operators

FINDING that a serious shortage exists in radio operators available for service on United States cargo vessels, the F.C.C. has suspended for six months the requirement of six months' previous service on board U.S. ships.

Persia

THE Persian Post and Telegraph Administration plan to erect twelve 100-watt regional transmitters which will relay the short-wave programmes radiated from Teheran.

Wireless Amateurs O.H.M.S.

IT is interesting to learn that almost half the members of the Ashton-under-Lyne and District Radio Society are serving with the Forces in various parts of the world. In spite of reduced numbers, the club is still able to carry on with its weekly meetings, and the secretary hopes that all members serving abroad as well as prospective new members will communicate with him at 7, Broadbent Avenue, Smallshaw, Ashton-under-Lyne.

Talking Books

IT is revealed in the 73rd annual report of the National Institute for the Blind that the recording studio for the production of "talking books" was destroyed as a result of enemy action. A temporary studio has, however, been in operation for some time and the recordings continue to be made. Recognising a possible shortage of the needles required for playing the records, the American Foundation for the Blind raised a fund for supplying them from America.

R.S.G.B.'s Successful Year

IT is learned from the latest issue of the *T. & R. Bulletin* that at the end of September the Radio Society of Great Britain had a credit balance three times greater than in September, 1939.

R.A.F. Men Want News

APPARENTLY there is a shortage of short-wave broadcast receivers in the camps in Canada where R.A.F. air crews are undergoing training. The men complain of the lack of "live" news from home.

FM Aerials

IN a statement clarifying the requirements of the U.S. Federal Communications Commission regarding the erection of frequency-modulation aerials on existing medium-wave mast radiators, it is pointed out that the installation of the FM aerial must not adversely affect the operation of the medium-wave broadcasting station.

Wireless and Youth

THE North Manchester Radio and Television Society is co-operating in the Government's Service of Youth plan by holding bi-weekly classes in morse and receiver construction on the premises of the Whitefield Service of Youth Club. The Society has just received a very cordial reply to a message of greeting which they sent to all American radio amateurs through the A.R.R.L.

The Institute of Physics

PROFESSOR SIR LAWRENCE BRAGG was recently elected chairman of the Institute of Physics. The following were also elected to take office on October 1st: Vice-president, Professor W. Makower; honorary treasurer, Major C. E. S. Phillips; honorary secretary, Professor J. A. Crowther.

Cossor's Progress

AN increase of £21,702 in A. C. Cossor's net trading profit of £157,730 for the past year is recorded in the report recently published.

NEWS IN ENGLISH FROM ABROAD

REGULAR SHORT-WAVE TRANSMISSIONS

Country : Station	Mc/s	Metres	Daily Bulletins (BST)
America			
WNBI (Bound Brook)	11.890	25.23	3.0†, 5.0, 6.0.
WRCA (Bound Brook)	17.780	16.87	3.0†, 5.0, 6.0.
WGEO (Schenectady)	9.530	31.48	9.0†, 10.55§‡.
WGEA (Schenectady)	15.330	19.57	6.45§‡, 9.55§‡.
WBOS (Hull) ..	11.870	25.27	9.0.
WCAB (Philadelphia)	6.060	49.50	12.30 a.m. (Mon.), 11.30‡.
WCBX (Wayne) ..	9.650	31.09	10.30.
WCBX	11.830	25.36	6.30‡, 7.15†.
WCBX	15.270	19.65	1.0‡, 2.0.
WRUL (Boston) ..	6.040	49.67	11.30§‡.
WRUL	11.730	25.58	11.30§‡.
WRUL	11.790	25.45	8.30*, 9.30§‡.
WRUL	15.350	19.54	4.0*, 8.30*, 9.30§‡.
WRUL	17.750	16.90	4.0*.
WLWO (Cincinnati) ..	15.250	19.67	5.0, 8.0.
Australia			
VLR7 (Lyndhurst) ..	11.840	25.34	5.20.
Egypt			
SUX (Cairo)	7.865	38.14	6.50, 10.10.
French Equatorial Africa			
FZI (Brazzaville) ..	11.970	25.06	8.45.
India			
VUD3 (Delhi)	9.590	31.28	1.30, 4.50.
VUD4	11.830	25.36	9.0 a.m., 1.30, 4.50, 6.15.
VUD3	15.290	19.62	9.0 a.m.
Japan			
JZI (Tokio)	9.535	31.46	8.0
JZJ	11.800	25.42	10.30.
JLG4	15.160	19.86	8.0.
Manchukuo			
MTCY (Hsinking) ..	11.775	25.48	8.0 a.m., 10.5.
Sweden			
SBO (Motala)	6.065	49.46	10.20.
Thailand			
HSP5 (Bangkok) ..	11.715	25.61	12.45.
HS6PJ	19.020	15.77	12.45.
Turkey			
TAP (Ankara) ..	9.465	31.70	7.15.
TAQ	15.195	19.74	12.15.
U.S.S.R. (Moscow)			
31-metre band ..	—	—	7.0, 8.0, 9.0, 10.15.
Vatican City			
HVJ	6.190	48.47	8.15.

MEDIUM-WAVE TRANSMISSIONS

	kc/s	Metres	
Ireland			
Radio-Eireann	565	531	1.40‡, 6.45‡, 6.50†, 10.0.

It should be noted that the times are BST—**one hour** ahead of GMT—and are p.m. unless otherwise stated. The times of the transmission of news in English in the B.B.C. Short-wave Service are given on the preceding page.

* Saturdays only. § Saturdays excepted. † Sundays only. ‡ Sundays excepted.

Short-wave Service Interruptions

Time Lost Through Ionosphere Storms

THE short radio waves are the most useful for communicating over great distances because they travel with relatively little loss from transmitter to receiver by way of the refracting layers of the ionosphere, and so escape the effect of ground absorption. Successful communication is, however, dependent upon the existence of normal conditions in the ionosphere layers. The diurnal and seasonal changes which occur there are taken account of by changing the transmitting frequency at suitable intervals. There remain certain abnormal occurrences in the layers which tend to cause interruptions to the short-wave services. These are of two kinds—sudden ionosphere disturbances and ionosphere storms.

The sudden ionosphere disturbance is of relatively small importance because of its short duration, which is usually not greater than 1½ hours. This does not mean that it is of *no* importance, but the time lost due to this cause on any circuit in the course of a year would not be very great. The ionosphere storm can have much more serious effects, and may last 10 days or more, so that it can be regarded as the principal cause of interruptions in the long-distance short-wave services.

Storm Statistics

An examination of some records of ionosphere storms which took place during 1940 shows that there were 57 storms during that year, of which 23 were of such slight intensity that they probably did not affect reception to any great extent. Of the remaining 34, 18 were probably severe enough to cause deterioration in reception in certain parts of the world, even with elaborate receiving equipment, while the whole 34 would probably impair or render impossible reception by ordinary receivers; for example, those possessed by the short-wave broadcast listener.

These abnormal receiving conditions prevailed on 71 days during 1940, so that conditions were normal, or practically so, on about 80.6 per cent. of the total days of the year. Of course, not all SW routes are affected by all ionosphere storms, so it is probable that only in the worst cases was reception affected for as much as 19.4 per cent. of the total time. Signal paths running in southerly directions, for example, would be affected considerably less than this. January and December were practically undisturbed months, whilst March was the month with the greatest amount of disturbance. During the winter conditions were by far the least disturbed, whilst the summer and equinoctial periods showed a similar amount of disturbance. This, by the way, was also the case during 1939.

There was a slight decrease in the amount of disturbance from 1939 to 1940, which may have been due to the fact that there was less sunspot activity in the latter year than in the former. It is almost certain that the agency which causes the ionosphere storm is an emission from the sun. In addition to causing ionosphere disturbances, this emission often causes abnormal fluctuations in the terrestrial magnetic field, and 50 of the 57 ionosphere storms of 1940 were accompanied by a more or less severe magnetic disturbance.

The general effect of an ionosphere storm is to cause a turbulence and afterwards an expansion in the ionosphere layers, so that the amount of ionisation per unit of space is reduced. Thus the radio wave does not encounter sufficient ionisation to effect refraction, and so it passes right through the ionosphere and on into space. If the transmitting frequency were lowered when the layer ionisation was reduced, refraction should again take place, and the storms of 1940 indicate that in the most severe cases a reduction in frequency of about 30 per cent. would have been necessary in order to ensure proper refraction. Thus the short-wave services might be maintained in some cases if, during the progress of a storm, a lower frequency were used. But, owing to the fact that the lower layers of the ionosphere are not, or are only slightly, affected by the storm, lowering the frequency would also have the effect of increasing the absorption to which the wave is subject because the main source of absorption is in the lower layers. Thus, whilst lowering the transmitting frequency would improve the refraction in the upper layers, the signals could not be so strong as on normal days, because of the incidental increase in lower-layer absorption at the lower frequency.

THE WIRELESS OFFICE on board S.S. *America*, now the United States transport *West Point*. The nine-foot console incorporates the controls of the three main R.C.A. radio-telegraph transmitters, whilst that at which the farther operator is sitting is the radio-telephone control panel. The three CW transmitters each have a power of 1 kW. and work on the short-, medium- and long-wave bands. The main console also has an aerial switching panel providing the selection of any of the five receiving doublets for either of the two high-frequency receivers. The ship's complete radio equipment includes eight transmitters, nine receivers, a direction finder, an automatic distress alarm and thirteen aerials.

UNBIASED

By FREE GRID

B.B.C. Illiteracy

I WAS talking recently about the deplorably slovenly dropping, by certain technical men, of adjectives and adjectival expressions such as the qualifying "per-second" in expressions such as cycles-per-second. A reader has written to me about this matter, and points out that a far more glaring error which is rampant is the dropping of the noun, leaving the adjective standing alone. He accuses the B.B.C. in particular of this boorish and illiterate abuse of the English language, and instances the regrettable use by announcers of the horrible expression: "It was announced on the Moscow wireless that. . . ."

I must say that I am heartily in agreement with him. One expects this kind of thing from women who, after all, cannot be expected to know any better, and who in the early days of electric light when I was young and unattached used to request me to turn out "the electric." Even men, however, are not entirely blameless in this practice, and one constantly hears loose references to St. Paul's Cathedral by people who ought to know better, but don't, and probably imagine in their ignorance that the word Cathedral is a noun. Only last week I had to reprove a well-known bishop for this error.

From the high and mighty B.B.C., however, with its tradition of pseudo-culture and education, one expects something a little better, and one is

"Pseudo-culture and education"

inclined to suspect that the scholastic attainments of some of the nabobs up at the big house are more apparent than real, like those of a certain gentleman much in the public eye, whose educational career is summarised quite truthfully in a certain book of reference as "Eton and Oxford," although actually he passed from Eton council school direct to a business college in the city of spires.

In my opinion there is too much of this sort of thing going on.

I FEEL firmly convinced that we shall eventually win this war, and win it outright, in spite of the well-meant efforts of our great Government Departments. The reason for my confidence is that, like Mr. Pepys, I have been gathering strength and comfort by reading the records of earlier wars in which we successfully snatched the torch of victory from the sea of red tape just as it was going down for the third time. It was apparently a very near thing in 1588, however, and the poor old torch had to be rekindled by the sea dogs of Devon who, owing to their rum-drinking proclivities, were fortunately able to do this by breathing hard on it.

Thoughts about the weird and wonderful ways of Government Departments are uppermost in my mind just now, as Mrs. Free Grid recently received one of those new-fangled photographic airgraph letters from one of the no-longer-little Grid Leaks, who is at present one of the King's hard bargains out in the so-called Middle East. Mrs. Free Grid, with a woman's love of the romantic nonsense that is written about the East, promptly announced that she could smell all the spicy scents of the Orient in the "notepaper."

I endeavoured, with the help of a little sulphuretted hydrogen, to enlighten her as to what the smell of an eastern town is really like, but she only told me not to be vulgar, nor would she listen to reason when I tried to explain to her that the paper on which the letter was delivered had never been farther east than Billingsgate. My choice of Billingsgate was an unfortunate one, as she immediately linked it up with the smells I had been creating, nor would lengthy explanations shift her, and in the end we were more at cross purposes and in a greater muddle than a couple of "permanent officials" trying to interpret an act of Parliament.

What I particularly wish to complain about in this photographic letter business is the fact that it should be fathered, and the science of photography favoured, by the P.M.G., a Government official who is paid—and well paid, too—to look after the interests of wireless and its satellite sciences. Surely it needed only a little imagination for even the P.M.G. to see that instead of making a soldier waste valuable paper and ink by writing a letter which is subsequently photographed, it would be far better if he were allowed to record his voice directly on to the film by means of a simple recording unit supplied to each battalion.

The P.M.G. has told us a lot about the enormous saving of weight and space effected by transporting the letters in film form instead of on paper, but, surely, still more weight and space could be saved by not sending them at all, but by despatching their contents direct to the Old Country by means of high-speed short-wave wireless telephony at a conveniently "slack traffic" time.

An Old Dodge

I say high-speed wireless and mean it, as by running the film or discs at top speed through the transmitter there would be no difficulty in disposing of several thousands of words in a few minutes, as in order to receive them it would only be necessary to run the receiving-station recorder at the same speed, an old trick that the Germans taught us in the last war.

"Spicy scents of the Orient"

The records would, of course, finally be run through a reproducer at normal speed and fed to a number of typists wearing headphones in order to be transcribed and despatched to the addressees.

This scheme has the very great added advantage that anybody who cares to pay an extra fee could buy the letter recorded on an ordinary gramophone disc, and thus be able to hear the voice of their absent son or other relative speaking to them, an advantage which would, without doubt, appeal to sentimental people like Mrs. Free Grid—and their name is legion—and result in great accretions to the P.M.G.'s coffers. I intend to raise the matter in the House at the earliest opportunity.

Replacing a Triode-Pentode

Heptode as a Substitute

THE triode-pentode has been used in many receivers as a frequency changer, and now that supplies are very limited the replacement of this valve has caused a serious problem. Several circuit modifications have already been suggested, and this note shows how a heptode may be used.

A typical mixer circuit using a triode-pentode is shown in diagram (a); cathode injection of the oscillator frequency is used. This circuit may be rearranged as shown in diagram (b) to permit the use of a heptode such as the Marconi or Osram MX40, X42 or X63; other valves having similar characteristics may also be used with this arrangement, which is identical to that recommended for the 6SA7.

The normal oscillator anode (G2) is joined to the screen (G3-5), and this is used as the oscillator anode; the tuned circuit L being connected in the oscillator grid (G1) circuit instead of to the oscillator anode as is usual with the triode-pentode.

(4) Earth end of cathode coil that used to go to C2, R2.
(5) Join oscillator anode to screen.
(6) Connect oscillator coil to oscillator grid via 0.0002-μF condenser C3.
(7) Connect 50,000-Ω resistance R3 from oscillator grid to earth.
(8) Re-align receiver.

The RF choke is, strictly speaking, no longer required, but will do no harm if it is left in place; the other components removed are not required in the modified circuit.

The success of this rearranged circuit is no doubt due to the comparatively high mutual conductance of the oscillator triode, formed by the oscillator grid (G1) and the screen grid (G 3-5), being much higher than when the heptode is used in the normal way with G2 as the anode.

The choice of heptodes available is considerable and in an AC receiver any of them should be satisfactory, though one with a four-volt heater is most convenient; but, providing a suitable heater supply is provided, those with other ratings may be used. For use in an AC/DC receiver it is essential to select one having the correct heater *current* rating; a small difference in heater *voltage* rating can be ignored.

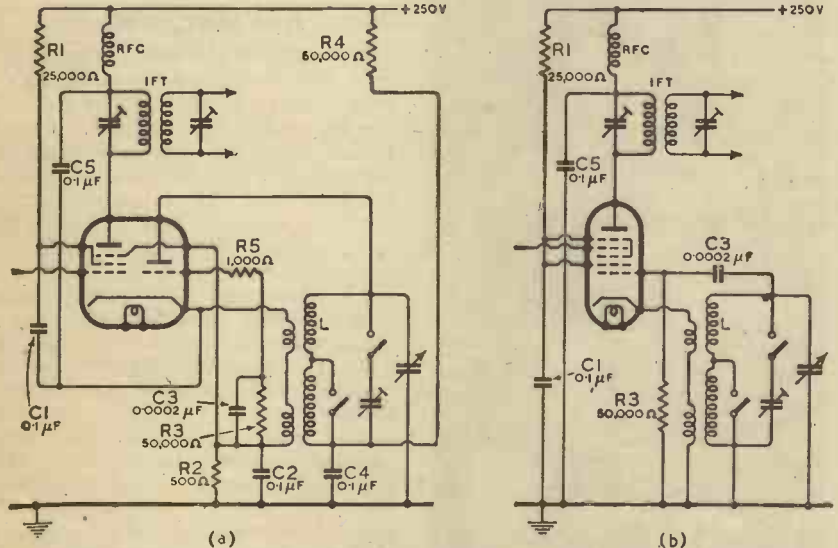


Diagram (a) represents a typical frequency-changing circuit with a triode-pentode valve; the use of a heptode as a replacement is shown at (b).

The following modifications will be needed:

(1) Change 9-pin socket to 7-pin.
(2) Remove R2, R3, R4, R5, also C2 and C4.
(3) Connect C1 and C5 to earth instead of to cathode.

G. R. W.

LETTERS to the EDITOR

The Editor Does Not Necessarily Endorse the Opinions of His Correspondents

Under-trained Service Men

THERE is little doubt that all those who are interested in the radio industry will agree with the views expressed in the editorial article of your journal of July last.

It is, however, permissible to ask why there should be a dearth of efficiently trained men in the industry. There must be some reason for such a position.

There are thousands of men in the country who are directly interested in the profession, and, indeed, employed in the industry, and it would be absurd to contend that a large percentage of them have no desire to become proficient. Consequently, the reason for the position stated in your article should be sought.

The following remarks may go some way towards its elucidation.

The process of manufacture of scientific instruments on a mass-production basis, presumably to keep the price at a low level—inconsistent with the real value—is open to criticism, for not only are the components produced *en masse* but the assembly and testing is done in the same way.

The remuneration paid to the employees is out of all comparison with the knowledge required to do the work efficiently; particularly does this apply to service engineers.

I am confident that the problem would be solved very easily if the manufacturers and dealers paid a remuneration compatible with the knowledge required for efficient assembly and testing of broadcast receivers and for the "servicing" of sets.

JAMES H. WEBB.

British School of Telegraphy,
London, S.W.9.

The Montreux Plan

YOUR recent article on the Montreux Plan brings to mind a feature in which that plan falls short of the pre-war wavelength allocation. I refer to the absence of any station having a frequency which is a simple multiple of 100 kc/s.

In the days when Droitwich was active on 200 kc/s this station was of considerable value for checking frequency sub-standards of the type used for general work in the laboratory; in particular it was very useful for adjusting frequency meters utilising a 100 kc/s oscillator as a basis.

In the Montreux Plan, Droitwich is set at 198.5 kc/s, and the only stations which might prove of some assistance in the above respect are Muhlacker on 580 kc/s, Marseilles on 780 kc/s, and Berlin on 880 kc/s.

Whilst admitting that the sole purpose of a broadcasting system is to provide a service for the general public, it would be pleasing to a great many scientific workers if it could also provide a service of value in the laboratory. There can be no objections on the grounds of expense to such an arrangement.

I am fully aware that the Montreux Plan was arrived at only after a great deal of study, but one wonders whether there would be any serious dislocation if the frequencies of all the stations in the long-wave band were to be increased by 1.5 kc/s.

In looking at the Montreux Plan as a whole, one will admit that it should achieve an advance over its predecessor, but at the same time one cannot help feeling that it has not really broken away from the old outlook.

There may be underlying objections to such a course, but could not the frequency separation between stations have been made 10 kc/s instead of 9 kc/s, and all the station frequencies in the medium wave band have been made evenly divisible by 10?

The result of this, in the medium wave band, would have limited the total number of station frequencies to about 100 instead of 114, but this political sacrifice might have been offset either by the reduction in direct interference between stations or by power increases in certain cases.

If the above course were possible, imagination may go farther and contemplate a broadcasting network in which frequency control is taken from one central station, all other stations being satellites.

Finally, it would be interesting to learn the extent to which the Montreux Plan was influenced by power politics, in more senses than one, and whether or not it will possess any real significance when reviewed against a post-war background.

"JAYBEE."

WIRELESS SALVAGE.—A photograph taken in a Royal Army Ordnance Corps workshop in which the components of damaged or obsolete sets are salved for future use.

Morse Key Manipulation

I WAS greatly interested in an article, "The Secrets of Good Sending," by Ensign E. L. Battey, U.S.N.R., in the September issue of *QST*. Except for one important detail, the methods advocated are consistent with British practice, but the following extract seems to describe a way of closing the key contacts that is diametrically opposed to our own.

"To close the key: The hand moves forward and downward, while the *wrist moves upward*. To open the key: The hand moves backward and upward, while the *wrist moves downward*. In effect, you should find your hand engaged in a rocking movement, forward-downward, backward-upward, forward-downward, backward-upward, etc. . . . Check your sending: If your wrist moves *downward* when you close the key, you do not have what is accepted as correct wrist action. The wrist should move upward when you close the key. If your hand or arm tires easily, recheck your wrist action. Proper wrist action is one of the secrets of good sending."

The italics are the author's. Expert operators here are agreed that the key contacts should be closed by *lowering*

the wrist; this view is, indeed, supported in *The Wireless World* booklet "Learning Morse."

Can it be that the difference between our key and the American pattern, which has a cranked bar and is mounted sufficiently far from the edge of the table to allow the operator to rest his forearm, accounts for a diametrically different manipulation procedure?

"RADIOPHARE."

Should Amateurs Know Morse?

HAS it occurred to some of the recent correspondents on this vexed subject that a very large proportion of our best radio engineers do not even pretend to know Morse?

It is not a necessary qualification for the majority of engineers who are concerned with the design and production of radio apparatus used in either peacetime or the war effort.

The P.M.G. licence is to enable an "Amateur" to carry out experiments in transmission, and not just to enable him to amuse and hold conversations with his friends. Is it not a fact that quite a lot of "Amateurs" scrape through a morse-test and then either buy a ready-made transmitter or assemble a kit of parts, and then with the usual "jargon," use it for their own entertainment? This is what seriously obstructs the really genuine members of the fraternity.

The writer does not know morse after 20 years' radio technical experience, but it seems to him that a goodly proportion of masquerading amateurs wish selfishly to limit the entry of further candidates to their ranks by trying to justify the "necessity" of morse code to all their would be playmates.

"NO-REMORSE."

THE letter by ex-G2ZL in the September issue calls for a reply.

I fully agree with Mr. Haydon about his point with regard to well-qualified and scientific workers who may have been prevented from obtaining a transmitting licence owing to their lack of a knowledge of morse, and the code proficiency test might be waived in cases where proof of technical or scientific ability is forthcoming.

However, to the general question: Should amateurs know morse? the answer is definitely in the affirmative.

In view of the great need for first-class code operators in this war, the abolition of amateur telegraphists would be the height of folly on the part of the licensing authority in the next post-war period. There may be another war after this one, and morse, not 'phone, will be the order of the day even in those future times. The G.P.O. might even contemplate raising the standard required, and introduce a procedure test as well as a speed test. An assured supply of ready-made operators would then be available in any national emergency.

All ex-holders of transmitting licences were permitted to use either telephonic or telegraphic communication by the terms of their licences, and the system they elected to use was entirely their own choice.

To say that morse transmissions were only a nuisance is rather a sweeping statement. In nearly twenty years' activity as an amateur, I came to the conclusion that one over-modulated or frequency-modulated 'phone transmitter was infinitely more of a nuisance than any one CW transmitter. The solution to this 'phone-*versus*-CW problem is the dividing of the bands, by international agreement, into sub-bands for each type. Then 'phone can QRM 'phone, and CW can QRM CW, and everybody will be pleased all round. (?)

WILLIAM JONES,
Colwyn Bay. Ex-GW6oK.

Physiological Effects of U-S-W Radiation

THERE are many people who are, like myself, continuously exposed to the radiation of ultra-short wave transmitters and, though pressure of work makes it impossible for me to make any usefully accurate observations, I think I can safely claim to have observed certain medical effects, the most serious being a sort of nervous exhaustion. A rough perusal of the *Wireless Engineer* index shows that such effects have been admitted for many years by various scientists and, due to the very large increase in the number of us who are exposed to waves of under one metre in length, I feel that someone ought to make an immediate investigation, or the war effort may suffer through the lessened efficiency of the now very scarce trained men.

"CENTIMETRE."

Morse by Gramophone

TWO new morse code instruction records have just been issued by Columbia. The recordings consist of 5-letter code and figure groups. At normal turntable revolutions the speeds are 7, 8, 11 and 13 w.p.m., but by use of the control on a portable gramophone a range of from some 5 to 15 w.p.m. is obtainable. The records, numbered DB2041/2042, cost 3s. each, plus 8d. purchase tax.

RANDOM RADIATIONS

By "DIALLIST"

Where are the HTBs?

FROM various places I hear of a shortage of HTBs. It appears that the shops find them not easy to get and a fresh supply is sold out almost as soon as it gets on to the shelves. I wonder why. So far as I know, our makers have been turning out a pretty good number of batteries. Perhaps they miscalculated a bit this year when they brought production down to summer level. We had such long spells of the kind of weather that only ducks like, that people no doubt stayed far more at home than usual, and made considerably increased use of their wireless sets to dispel the gloom for which they held St. Swithin responsible. It's really surprising that so many battery sets are still in use. I know heaps of folk who have mains electric lighting, but continue to use battery receivers for one reason or another. Some can't be bothered to change; others find the battery set less noisy. And then there are, of course, the portables, which have enjoyed renewed popularity during the last two or three years.

Life in the Old Sets Yet

Some five or six years before the war I remember talking to an American wireless man, who predicted that in this country the battery set would very soon become a back number. Knowing the conservatism of my race I was bold enough to offer to bet him that there'd still be a couple of million or so in use five years from then. He didn't take the bet—I only wish he had! I'd have won handsomely. It looks as if there is lots of life in the battery set yet, and even had there been no war I doubt whether there would have been any great falling off in the numbers in daily service.

A Dash in Time

RATHER foolishly, I suppose, I was wearing my best uniform tunic in the lab. the other day. It ought to have been battle dress, which doesn't cost much, and not a number one uniform, which most emphatically does nowadays. At lunch-time a brother officer kindly called my attention to some tell-tale purplish marks on the left sleeve. We'd been using accumulators, and my mind leapt instantly to thoughts of dilute sulphuric acid—I remembered that one of the said accumulators had been in a rather messy state. Undoubtedly it had left its mark in the form of a corrosive pool on the bench, and I'd planted my elbow therein. A dash back to the lab. and SOS shouts for one of the lab. men followed. He, noble fellow, produced the ammonia bottle and gave the sleeve a good dash of it. With streaming eyes we agreed, after a subsequent examination, that first-aid had been rendered in the nick of time. You can fear the worst if the stains have become red instead of purple, and luckily sulphuric acid is slower in getting to work on wool than on cotton. I trust there won't be any unwelcome sequel.

What's Your Solution?

IN the midst of an abstruse scientific discussion the other day one fellow produced a limerick that tickled me—we were talking of the beginning of things.

There was a materialist who,
When asked how the Universe grew,
Said cos θ sin ϕ
By the cube root of π
All over factorial Q.

To which another, after a little thought, retaliated:—

A deep-thinking Fellow of Trinity
Replied, "That is pure asininity.
Nay rather, I'd say
'Tis the xth power of j
Divided by minus infinity."

They look far better if you write them in mathematical notation, but I'll spare the printer that! Can you add to the gaiety of physicists in wartime by further solutions in deathless verse?

Doing it in Style

AMERICANS never do things by halves, as witness the noble aid they're giving us in the present bit of bother with Comrade Schickelgruber, *alias* Hitler. I was vastly entertained by reading an account of the opening of KGEI, the new 50-kilowatt station of the American G.E. Company at San Francisco. The station came on the air officially on September 4th. It is intended first and foremost as a link with Latin America, though it also broadcasts to Asia, Africa and Australasia. No fewer than 20 consular representatives of as many Central and South American states spoke at the inaugural broadcast. That's the way to do things. There's nothing like starting with a real wallop, and I'm sure that KGEI will reap its reward, in the form of a huge band of regular listeners, for this well-planned send-off. The station, by the way, works regularly on 15.33 megacycles between 9 a.m. and 2 p.m., with its transmissions beamed on South America. Its broadcasts to Asia, Africa and Australasia occupy 9 hours a day, and the frequency used for these is 9.67 Mc/s. Times are not given, but from the frequency one deduces that they will be in the GMT and BST small hours.

A Valve Ramp

REPORTS reach me that standard British-made valves are being offered and sold by some unscrupulous dealers at prices a good deal above those shown in makers' catalogues. There are black sheep in every flock and at a time when there is a shortage of certain kinds of valves wanted for renewal and replacement purposes, it isn't, perhaps, surprising that in some quarters attempts at this despicable kind of profiteering are being made. If this ramp is tried on you, have no mercy: report the matter at once to your local Price Regulation Committee, who should take action without delay if they know their business. The valve-makers are keen to stop this kind of thing, and they will be glad to hear from you if their wares are offered at prices above the proper limit.

No Rush of Supplies

At the same time I was sorry to see in one or two of the lay papers a suggestion that the shortage of valves and other components was—or would shortly be—a thing of the past. It was rather more than hinted that Government Departments concerned were so anxious to keep every possible receiving set in action that they had consented to, or even spurred on, the release for sale of vast quantities of valves and other replacement components. The Departments in question are keen enough to keep all of us in touch with events of the day through the medium of our receiving sets. But they can't do the impossible. Valves, transformers, condensers, resistors, and so on, are short because other Government Departments absorb almost the entire output of many makers as fast as they can turn them out. These radio parts are urgently required in vast numbers by the fighting Services, whosee needs must be the first to be met in wartime.

The suggested release, therefore, could not possibly be made. Many of you, I fear, may have been disappointed when you read of the flow of good things which seemed to be coming your way and later found that they were still as difficult as ever to obtain. Don't grumble! Make do with what you have, even if it does mean poor reception. Remember that the needs of the Services are huge and of paramount importance. I can assure you, as one of the bloodthirsty and licentious soldiery, that we waste nothing in the way of radio bits and pieces, and that everything that comes our way is utilised to the full.

Gay Deceivers

AT one time of day the language used by its announcer was a pretty sure guide to the nationality of a wireless station. If in the course of your DX searches you came across a station transmitting Spanish, you could be fairly sure that if it wasn't in Spain it was in South America. But in these days of multilingual propaganda and news bulletins all that has gone by the board. Your Spanish-speaking station may belong to almost any country but Spain! All that you can do if you want to identify with certainty is to wait for the call sign—an exasperating process at times, for signals have a way of fading out or being drowned by interference of one kind or another just as the long-awaited call sign is about to be given. And what is perhaps almost more annoying after long and patient attempts to identify what you fondly believe to be something distant and not often heard is to find, eventually, that you have been listening to one of the B.B.C.'s foreign transmissions. You don't, of course, do that kind of thing if you're using your own carefully calibrated set at home. But many of us to-day aren't at home and aren't using carefully calibrated receivers. We sit down for a spell on the short waves using whatever set is available; we may, in fact we frequently do, succeed in pulling in interesting stations; but how often are we led up the garden for a while by the stations that are not what they seem?

Not New Zealand

The other day I picked up a signal on the 16-metre band that had all the appearance of coming from a distant station. A news bulletin was in progress. The language was English, but the announcer was unmistakably a New Zealander. Further, he was giving news of a particularly local type: the prices fetched by one big farmer's sheep at market; a story of a competition in aid of a war charity in which the first prize—six months' free travel on one city's tramways—was won by a tram conductor; accounts of engagements, weddings, and so on. Old hand though I am, I was fairly caught. I thought it must be a station in New Zealand that I'd not previously logged, and held on. It was the B.B.C., of course. The bulletin had been read by a New Zealander, which didn't make things any easier for the wartime DXer.

RECENT INVENTIONS

A Selection of the More Interesting Radio Developments

ELECTRON MULTIPLIERS

RELATES to the electrode arrangement of a two-stage electron multiplier, which is described as "a convenient compromise between the single-stage multiplier giving low multiplication and the complicated multi-stage multiplier giving high multiplication." This is particularly so when the cathode is heated and the multiplier forms part of a valve amplifier.

The electrode arrangement consists of a heated cathode of considerable length surrounded by a control grid and split cylinder which divides the emitted electrons into two beams travelling in opposite directions. Each beam is first split into two parts by a single-wire dividing electrode, so that the two halves strike the primary target along diverging paths, the second target and collecting anode being arranged in the clear space or angle in between.

The various electrodes are so biased that secondary electrons emitted from the primary target are first drawn back towards the second target and are then drawn onwards to the collecting anode. Exactly the same happens to the other beam which is formed near the cathode, except that it travels in the opposite direction and is directed against target electrodes symmetrically arranged on the other side of the cathode.

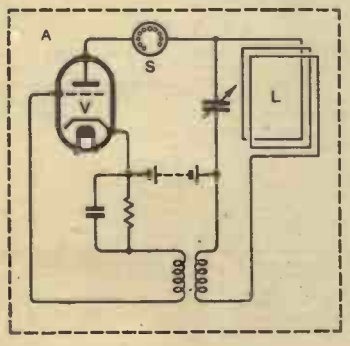
The Marconi-Osram Valve Co., Ltd., and G. W Warren. Application date August 16th, 1939. No. 532082.

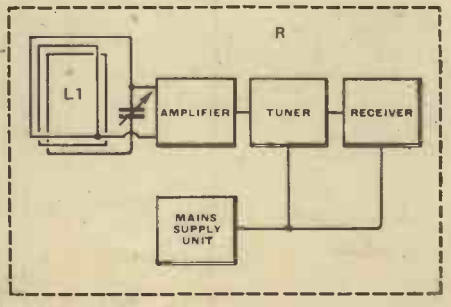
REMOTE TUNING-CONTROL WITHOUT LEADS

A WIRELESS set is controlled by inductive action from a distance, no wire connection being required between the set and the control unit. The latter may be portable. The effective range of operation is preferably less than one-sixth of the wavelength used to produce the inductive control field. A control frequency of 375 kc/s is mentioned as being effective at a distance of some 75 feet.

Advantage is taken of the in-phase magnetic "induction" field produced by an energised coil as distinct from the radiated magnetic field, which is in phase-quadrature with the exciting current. The inductive field has the property of decreasing in amplitude as the inverse cube of its distance from the coil, so that it has little disturbing effect at a distance, though it is considerably stronger than the corresponding radiation field at distances less than one-sixth of the wavelength.

The figure shows a schematic arrangement in which the remote-control unit A includes a valve oscillator V, an inductive loop L, and an impulse switch S of the automatic telephone type for dialling the tuning-control impulses. The distant receiver R includes a pick-up coil L1, preferably located at the bottom of the cabinet, and coupled through an amplifier to the receiver proper.

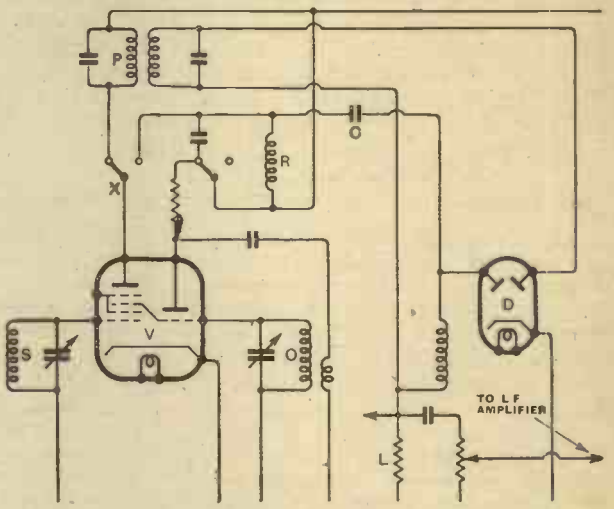




Circuit arrangement for "wireless" remote control.

A triode-hexode valve V normally serves as a frequency changer, mixing the input signals from circuit S with local oscillations developed by the triode section in the circuit O, and feeding the resulting beat frequency to the primary of the intermediate-frequency stage. These are the conditions when the switch X is in the position shown, for distant reception.

When the switch X is thrown over, the anode of the hexode stage of the valve V is disconnected from the primary P and is conected to a radio-frequency choke R which is coupled through a condenser C to a double-diode rectifier D. Simultaneously the anode of the triode or oscillator section of the valve V is disconnected from its high-tension supply and so ceases to function. The circuits are now set for straight reception. The load resistance L is made common to both the rectifying diodes D so as to avoid the necessity of inserting another switch in these circuits.



Circuit arrangement for alternative superhet or TRF reception.

R. M. Electric, Ltd., and G. H. Bradbury. Application date July 6th, 1939. No. 531623.

FROM SUPERHET TO STRAIGHT

THE figure shows the circuit arrangement of a receiver which can be used at will either as a superhet for long-range selective reception, or as a straight set to secure better quality at shorter distances.

STERILISING BY HIGH-FREQUENCY RADIATION

INCREASING use is being made of high-frequency waves for sterilising or drying substances as well as for curative or medical purposes. Special advantages are claimed in this connection for waves of the order of a metre or less in length. It is, however, difficult to build up and control the incidence of a wave of this dimension. If an ordinary tuned circuit is used, the area of the useful field either becomes too small, or else most of the energy is lost by radiation. An alternative method is to apply what might be called "optical" methods of reflection, and so build up a stationary wave system at a definite point.

The invention is a modification of the second method. Waves of the required length are fed through a transmission line to a quarter-wave dipole, which is adjusted inside a copper box or casing of dimensions comparable with the wave, until the energy reflected from the sides of the box combines with that radiated from the aerial to build up a stationary wave inside the box. The substance or patient to be treated is then placed on

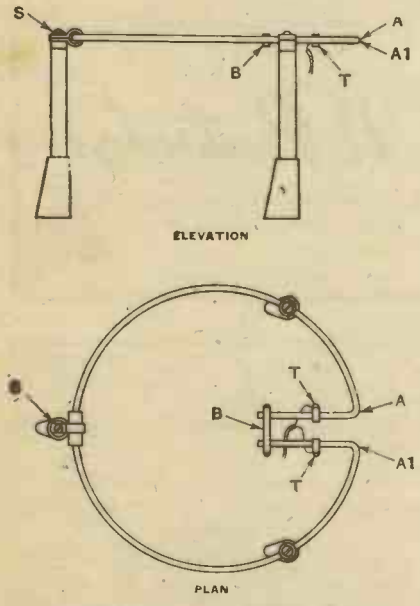
an insulated support and brought into a " loop " of the wave where the field is intense and of constant amplitude.

The General Electric Co., Ltd., and E. C. S. Megaw. Application date September 1st, 1939. No. 532502.

AIRCRAFT DF AERIALS

FOR navigational work, such as flying along a beam or for making a blind landing, an aeroplane is usually fitted with a straight dipole aerial which has a pronounced directional effect. This is not always an advantage. For instance, when the 'plane is manœuvring before landing, or when it is homing in a cross-wind, the directional effect will lead to a definite falling-off in sensitivity, because the aerial in such circumstances is not orientated in the direction of maximum pick-up.

To overcome this difficulty, the straight dipole is replaced by one of the shape shown in plan and elevation in the figure. The two " free " ends are mounted in an insulator S from which they are bent round in circular fashion, brought close together at A, A1, and then turned inwards. A strong copper bar B allows the effective aerial length to be adjusted. Signals are taken off by a transmission line connected to the terminals T.



Design of dipole for aircraft homing.

The aerial is non-directional in its own plane, whilst its sensitivity is approximately the same as that of an ordinary straight dipole.

W. H. A. Thiemann (Communication by Bendix Aviation Corpn.). Application date May 25th, 1939. No. 532107.

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McCLURE Feeder Unit, ACF5 or ACF4; price, details.—Audsley, 328, Dewsbury Rd., Wakefield. [9764

WIRELESS WORLD 2-R.F. Straight Set (W.W., Nov. 18th, '37).—Widdup, Reedham, Poynton Park, Poynton, Cheshire. [9741

USED Three-wave Battery or Mains Receivers; top prices paid for good quality machines.—Tregunna, 15, High Cross St., St. Austell. [9721

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2-STAGE A.C. Gram. Amplifier, for use on 230v. A.C. mains, less speaker and pickup.—Shelley, Flower Walk, Guildford. [9757

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BAKERS SELHURST RADIO, 75, Sussex Rd., Sth. Croydon. [9770

"GOODMAN 8" permanent magnet moving coil units fitted multi-ratio output transformers, very sensitive, excellent reproduction, new in original cartons, 22/6 each, carriage paid, cash with order.—P. & F., 49, John Bright Street, Birmingham, 1. [9751

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SPEAKERS.—Magnavox 66 for A.C. mains, Goodman 10in. H.F. P.M., R.K. 12in., 6v. field; offers.—Jolly Gardener, Maidens Green, Bracknell, Berks. [9766

Wanted

WANTED, Rola G.12P.M.—Partics. to Durnford, 19, Harlington Rd., Sharpenhoe, Barton, Beds. [9781

GOODMAN'S Infinite Baffle Speaker wanted; good condition.—Details, Russell, 41, Northway, Erith, Kent. [9733

WANTED, Goodman's Infinite Baffle Speaker; new and unused; state speech coil impedance.—Harvey, Ideal Buildings, Kidderminster. [9738

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OSCILLOSCOPE, Supreme Model 546 3in. laboratory type for all radio, P.A. and television testing, suitable for 250 volts, 50 cycles supply, price £25.
Signal Generator, Supreme 582-A Push Button, for 250 volts, 50 cycles supply, price £30.
C.C. Capacitor, Solar, price £10.
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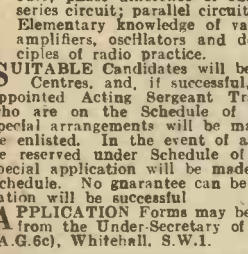

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