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Radio World

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MARCH 15 1945

★ Some practical ideas about high-fidelity reproduction

★ Second of the new series on fundamentals and radio theory

★ Two handy receiver designs featuring latest circuit ideas

★ Shortwave notes and loggings for keen DX enthusiasts

Hanes

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THE AUSTRALASIAN RADIO WORLD

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ALL-WAVE ALL-WORLD DX NEWS

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EDITORIAL

The future of the radio enthusiast who wants to experiment with transmitting appears to be assured. Those who want to own and operate their own transmitters should receive every encouragement and there is every evidence that this will become official policy in the immediate future. There is even a possibility that "hams" will be back on the air before the war is completely cleaned up.

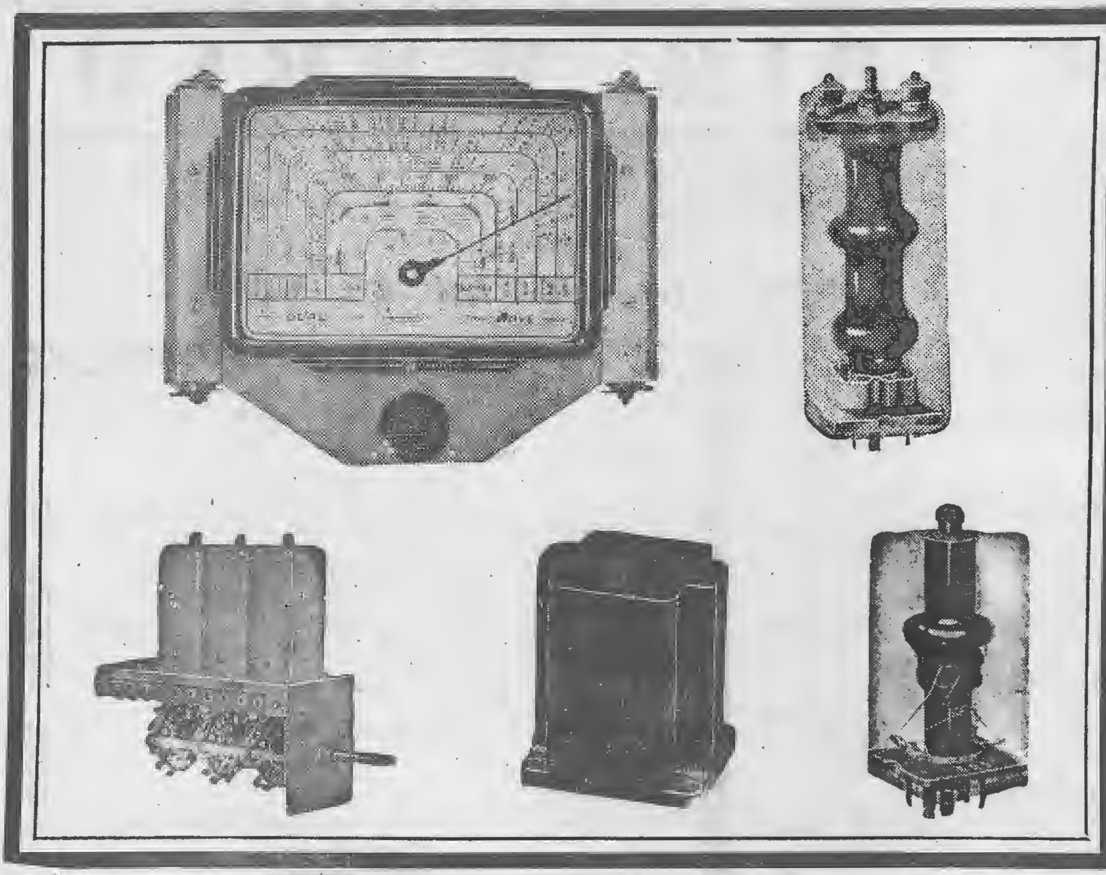
Restrictions will be unavoidable, of course. Considerable control will be necessary to prevent the ether being cluttered up, but it must be gratifying to hams to know that their war effort has been fully appreciated.

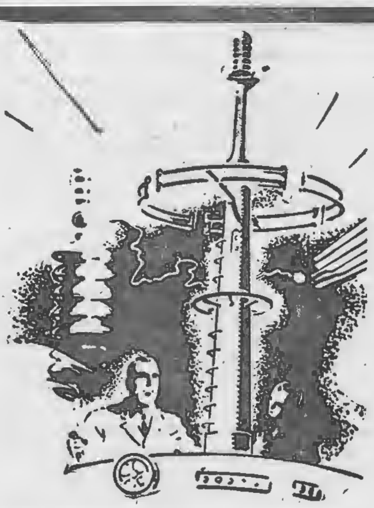
Modern warfare is a matter of the finest of technicalities and it has now been revealed that one of the biggest factors in the winning of the Battle of Britain was the successful application of radiolocation technique, or radar, as we now call it for short. Just how many "hams" were directly connected with the development and application of radar is not known, but it is a pretty safe bet to say that probably 90 per cent gained a lot of their practical knowledge from radio experimenting.

Now, with the return of peace, the logic of encouragement is clearly evident.

Recently, several committees in the United States have been considering proposals for the allocation of post-war frequencies. It is noteworthy that not one committee has suggested any curtailment of the amateur bands and the only point in doubt concerns just how many additional bands should be handed over to the "ham." One suggestion is to add a "ham" band at around 15 metres and this would appear to be a most excellent one for DX work.

A. G. HULL.





A CIRCUIT FOR D.C. POWER

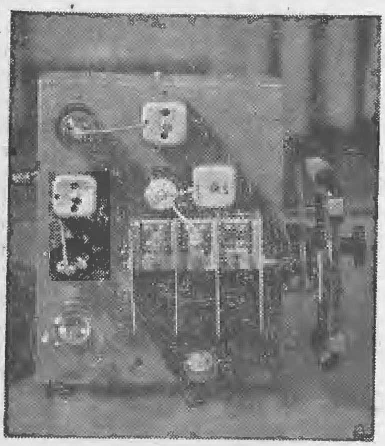
THREE VALE, TWO ELECTRIC LAMP A.C./D.C. SUPERHET

By
JOHN BRISTOE
Radio Manager
Denham's (M'bro) Pty. Ltd.
Maryborough, Q.

AT different times, in journals and books, I have noticed several types of small sets using a few valves, so I am submitting a circuit of my own for such a small set.

No Power Transformer

It contains three valves, all dual-purpose types, and two electric light bulbs. The electric light bulbs are essential and save the power transformer. They also make it possible for the set to operate on D.C.



A plan view of the set.

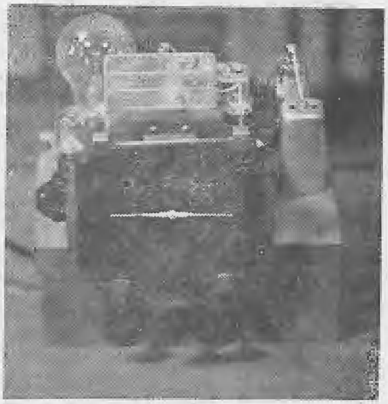
current as well as A C. The small 15 watt bulb is in the h.t. line and is necessary as the 12A7 is not suitable for operation straight from the 240 A.C. supply, but intended for 110 volts which is the usual domestic supply available in America. The 60 or 75 watt lamp is in series with the heaters of the valves. I mentioned 60 or 75 watt as the voltage of various districts appears to differ quite a lot. Try the 60 watt first and if the heaters are given sufficient voltage leave it in. If not, try the .75 watt as this increases the voltage on the heaters.

As a Reading Lamp

The 15 watt lamp just glows faintly and if mounted behind the dial will serve to illuminate. The large bulb glows normally and can be used as a reading lamp if mounted on the top of the cabinet and a shade fitted to it. On the original, I use this at night time, and during the day have a soldering iron plugged in instead of a lamp. Of course, it is the same wattage as the bulb. This arrangement suits me as I use the set as a monitor in my workshop.

Performance

Well constructed, with good components and properly adjusted, this set will, and the original does, perform as well as numbers of 5 valve standard type sets that I have heard. The valves perform the following functions:—6A8G: the first detector, oscillator and mixer; 6P7G: I F. Amplifier, triode detector and a reflexed driver; 12A7: output pentode and rectifier. Count them up and you see you have all you need for a good little set. Naturally I do not expect many will attempt to build this set owing to restrictions and difficulty in obtaining the required valves, but a few may have sufficient parts lying around to do it. The following may be of in-



Front view of the chassis.

terest: The 6A8G could be substituted with 6J8G or 6K8G. The 6P7G has only one substitute—the 6F7, although I think the 12B8G—a fairly modern valve not used much in this country could be used.

A Suggestion

I would also be inclined to try a 6J8 in this position. As far as I know the 12A7 has no near replacement although there are a few valves with higher heater voltages that would perform the same operations. These would require a change in the size of the lamps, and shunts

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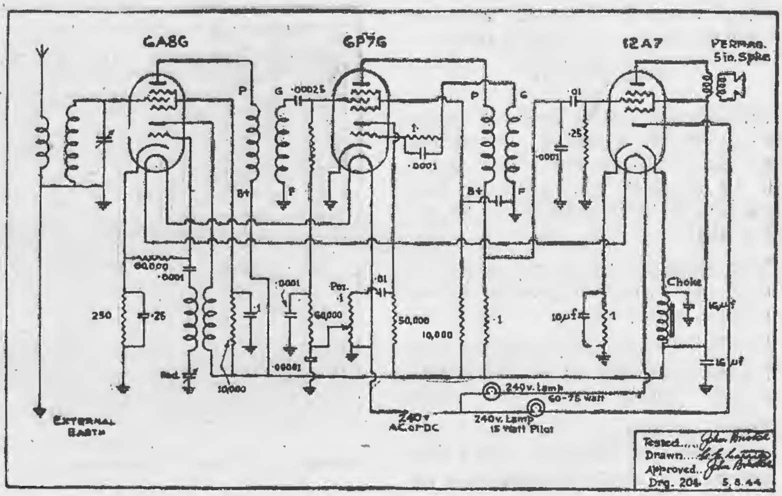

The circuit diagram. Note precautions necessary with "live" chassis.

DOWN TO EARTH

The Practical Aspects of High-Fidelity Reproduction

> **An interesting article on high fidelity, by O. B. Hanson, Chief Engineer of the National Broadcasting Co. of U.S.A., and reprinted by kind permission of "Radio," technical monthly published in New York.**

THE term "high fidelity," as used at present in the general radio and sound reproduction field, has come to mean an extension of the audio range to the upper frequency limits of audibility of the human ear, as contrasted with a range limited to the usual 4,000 or 5,000 cycles. In reality, the term "high fidelity" is comparative, and it would be more correct to think of it as "higher fidelity."

Frequency Modulation

Today there is available to the public a new system of programme transmission, using frequency modulation of the very high frequency radio spectrum, where suitable channel spacing has been allocated by the FCC so that a wide audio band can be transmitted. In the interest of providing the public with a better radio broadcasting service, every advantage should be taken of frequency modulation toward establishing improved standards of transmission and reception. However, in determining these standards, it is quite important to take a practical view of what constitutes **realisable** high fidelity, bearing in mind that, in the overall result, various practical mechanical and electrical limitations, some physiological and psychological phenomena and, last but not least, the actual programme content, are elements fully as important as a theoretically complete sound spectrum, or perhaps more so.

True Fidelity

Fidelity implies a faithful reproduction of the original, a condition which in audio system cannot actually be attained but, at best, only approached. True fidelity would require that:

1. The system not discriminate in any of its component parts against any frequency within the range under consideration.
2. No component part of the entire system introduce false harmonics.
3. There should be no amplitude limitation of any portion of the spectrum in either transmission or reception.
4. The system be free from phase distortion.
5. The system be free from extraneous noise.
6. The loudspeaker and its driving amplifiers be capable of reproducing without distortion the full frequency range at loudness levels suitable for all listeners.
7. The acoustics of both the pickup and listening spaces be suitable.
8. The spatial relationships of the sources of sound be transmitted and reproduced. This last probably requires some form of binaural or stereophonic system, neither of which is economically feasible for general public service at this time.

A system as described above, with exception of binaural or stereophonic transmission, is not too difficult of realisation from a transmitting standpoint. It might be closely approached in a receiver reproducing system, but the cost would probably be beyond the value which would be placed upon it by the purchasing public, particularly if the receiver were required to reproduce frequencies from 30 to 15,000 cycles.

It is curious that the emphasis in general discussions of high fidelity thus far has been on an extension of the upper portion of the sound spectrum, and little has been said about the required **balance** between said upper portion and the lower frequencies. Actually it has been discerned on the basis of much observation that a balancde frequency response is quite essential to programme enjoyment, although this balance factor has not yet been reduced to a rigorous mathematical formula. One authority has said, and our experience has confirmed this general statement, that the product of the lower and upper frequency limits should equal a number in the vicinity of 500,000, and a simple example will show the approximate validity of this hypothesis as indicating the importance of balance. A system, the frequency response limits of which are 50 to 8,000 cycles, a total range of 7,950 cycles, is conceded as satisfactory by most authorities. If we retain

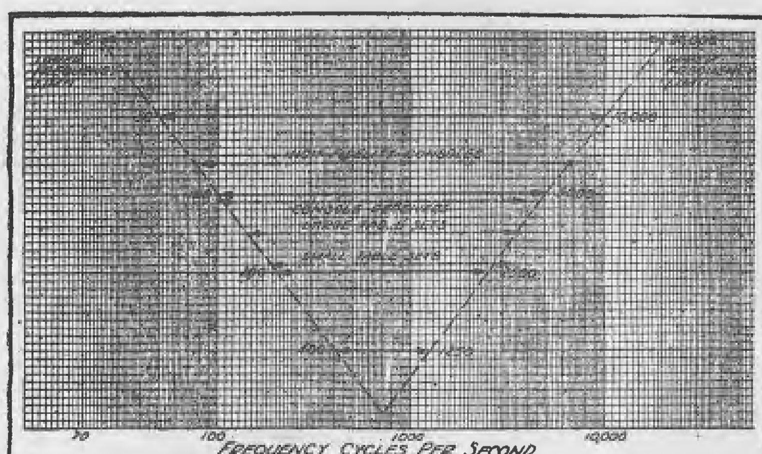

Fig. 1.—Preferred lower and upper frequency limits. Product equals 500,000.

this same range and compare it with a range of from 250 to 10,000 cycles, there is little question that the former is preferable for reasons of general "naturalness" but particularly because of the reproduction of a substantial range below 250 cycles. Note that, in the 50 to 8,000 cycles case the bulk of programme energy is in the band centring about a point approximately at 700 cycles.

Preferred Limits

The attached curve in Fig. 1 shows preferred lower and upper frequency limits in which the balance between the lower and upper portions is properly maintained. It will be noted that the product of the upper and lower frequency limits, as has been specified, is approximately 500,000. As an interesting fact in this connection many of the better home radio receivers of conventional type seem to fit surprisingly well within these frequency limits.

Possible Extensions

An extension of the frequency range to, perhaps, 17,000 cycles and down to 30 cycles would encompass the entire audible spectrum, but at only a small percentage of the total time would there be any appreciable energy in the region above 10,000 cycles. Reproduction of frequencies above 10,000 cycles adds only to the enjoyment, if that is the word, of such things as key jingles, footsteps, handclapping and various extraneous noises (non-musical) from musical instruments, as resin squeaks, air rush from wind instruments, and the like. These "sound effects" can hardly be considered essential or worth high cost to attain!

Mellow Tone

Experience and various surveys have shown that, even when listeners have receivers capable of reproducing frequencies up to 5,000 cycles, they usually operate the tone control to restrict the audio range to an upper frequency cut-off of somewhere between 2,500 cycles and 4,000 cycles. Reasons given for this are that the "tone is mellower," "more pleasant," "less obtrusive," etc. Many listeners who are musically trained and who appreciate symphony and opera are, strangely enough, numbered in this class, indicating that this procedure does not stem from uncultivated tastes but has some other, more general, basis.

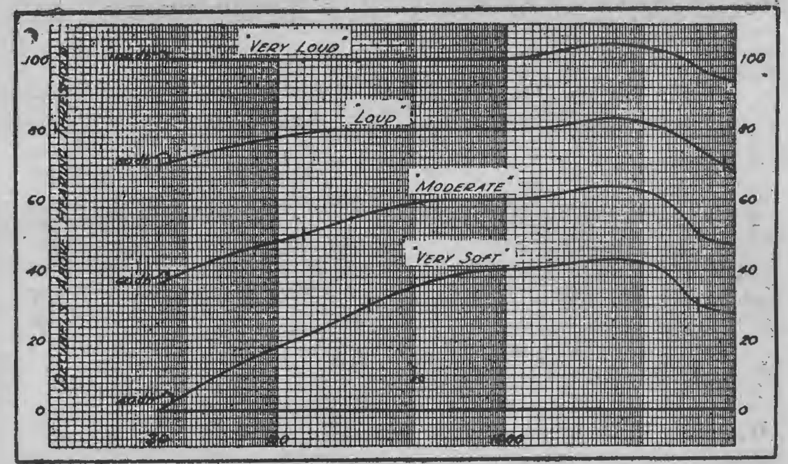

Fig. 3.—Frequency response of normal ears at different loudness levels.

It has been claimed that, if distortion and noise were eliminated from the higher frequency band, the public would then prefer the extended upper range. Pehaps so, if the higher range is properly balanced by adequate bass reproduction. Distortion and noise are unpleasant at any portion of the sound spectrum.

Adequate for Intelligence

Receivers, which at present provide millions of listeners with many hours of enjoyment, seem generally adequate for reproducing the intelligence and entertainment contained in the programme material. The witticisms of Charlie McCarthy, for example, are just as humorous on a receiver whose frequency range is 200 to 3,000 cycles, as on a higher fidelity system.

In this connection, it should not be overlooked that the entertainment and attention engaging factors in musical listening are not concerned with quality alone. Such matters as appreciation of technique, melody itself, rhythm and the like, are of great importance to the musical ear and all these of course can be reproduced satisfactorily within a reasonably restricted frequency range.

Table Models

The average radio listener purchases the table model receiver rather than the console. The former type of receiver cannot adequately reproduce bass frequencies, the fundamental reason being lack of sufficient physical size. It is only in the console type that adequate reproduction in the low frequency range can be approached, but few even of this type have provided really good bass response free from noticeable cavity resonance. The higher frequencies, however, may be reproduced with the smaller receivers assuming proper design, but

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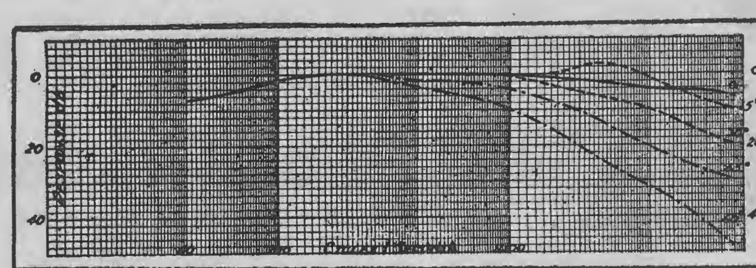

Fig. 2.—Relative response of listener at various angles to loudspeaker.

HIGH FIDELITY

(Continued)

generally at the expense of an un-desirable directional characteristic. This varies with frequency in the preponderant majority of loud speakers, so that reproduction of these frequencies is accentuated in front of the speaker and decrease with the increase in angle from the speaker axis. This is shown in Fig. 2, and it can be seen that the response at 45 degrees is substantially less than optium, even at frequencies as low as 3,000 cycles. A true higher fidelity receiver must so distribute the higher frequencies that, within a specified solid angle the response at all frequencies is substantially uniform.

Studio Conditions

The acoustical conditions of the studio and listening space can be controlled only over a frequency range approximately of 64 to 8,000 cycles, as design data and experience with materials and completed rooms are available only within those limits. At frequencies of 4,000 cycles and higher, the absorption contributed by the air itself, at usual values of relative humidity becomes of increasing importance. At 10,000 cycles and a relative humidity of 50%, the absorption of the air limits the reverberation time to about 1.5 seconds, even though the walls, floor and ceiling are perfectly reflective; at 12,000 cycles the limit is approximately 1.2 s[illegible]ds and at 15,000 cycles about [illegible] seconds. This factor should not be overlooked as it is one relatively fixed limit which certainly [illegible] affect consideration of higher fidelity, not only in the studio but also in the home.

Judging by Ear

The ear, the final criterion of judgment, is also to be taken into account, as the higher frequencies can only be detected by relatively young listeners, since hearing loss at the higher frequencies increases with age. The curves in Fig. 5 show the results obtained by the U.S. Public Health Service in this field. Although few measurements have ever been made above 10,000 cycles indications are that the curves do not trend upward!

Programme fidelity is also determined by the loudness level at which the loudspeaker is operated. Curves in Fig. 3 show the frequency response of normal ears at four listening levels, "normal" ears being those of young people about 20 years of age. Note that only at the "very loud" and "loud" listening levels, 100 db. and 80 db. above the hearing threshold, respectively, is the low frequency response of the ear substantially flat. The decreased response of the ear at 50 cycles, 100 cycles and 200 cycles, as compared with 1,000 cycles, would mean that at these frequencies the lows would sound at a much lower level than expected.

At Soft Level

In the case of very soft listening conditions the response would further tend to be obscured at the low frequencies by local airborne noises, as this listening level compares with average residential noises. Any decrease of more than 10 db. or so below this level will generally be obscured or masked by said noise.

The response of a young listener seated at 45 degrees from a radio receiver (with a reasonably uniform response up to about 10,000 cycles) operated at a loudness level of 60 db., which is "moderate" listening level, is shown in Fig. 4.

Compensation Desirable

Thus it is apparent that the higher the fidelity the receiver should include compensation for listening level effects in the volume control used with the receiver to provide uniform loudness at low frequencies. This device could also be used to compensate, partially, for the directivity of the loudspeaker, where adequate distribution cannot be attained in the speaker design. Such a "tone"-compensated volume control will then discriminate as the volume is lowered against the middle frequencies in favour of the low frequencies, the effect to the ear being more pleasing reproduction at the usual listening levels, which are commonly in the "moderate" classification.

The preponderant majority of sound systems are now, and will be for years to come, as far as can now be visualised, non-aural systems, whether they are utilised for recordings or for radio broadcasting. This fact alone indicates a fundamental departure from perfection because of the absence of true space consciousness of the sound sources.

Other Factors

Some other factors occurring in the general high fidelity problem, such as random noise and distortion, may also be mentioned. Since distortion components are multiples of fundamental frequencies, and since many audio devices, particularly recordings, have varying degrees of inherent distortion, difficult to eliminate, a wider band will increase the effect of same. This causes much of the upper frequency "fussiness" generally in evidence on most attempts at wide band reproduction. The phase distortion introduced by most sound systems is not believed to be a serious problem, as the ear is apparently not sensitive to moderate phase changes. The phase characteristics should, however, be uniform. Distortion must be kept to the lowest possible value and more attention should be directed to investigation and elimination of cross-modulation products as compared with present stress on the more simple harmonic distortion effects.

Multi-path Effects

Multi-path effects resulting in distortion are observable in reception on both amplitude and frequency modulation systems. This form of distortion, when it occurs, can be more noticeable with frequency modulation, and this effect has been observed in certain instances. It is possible that some listeners will be subject to this distortion, the efforts of which increase with an extension of the aurio range and deviation; however, good limiting in a frequency modulation receiver should minimise this form of distortion.

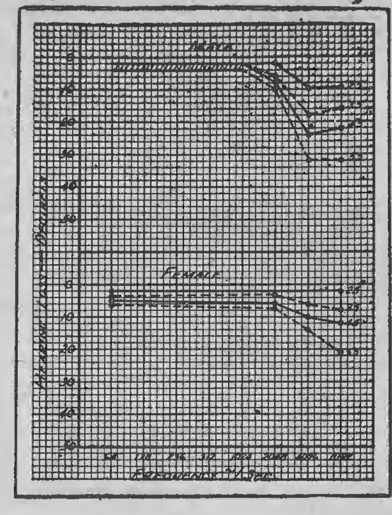

Fig. 5.—Hearing loss at various frequencies for different age groups.

Extraneous Noise

Random noise is directly proportional to band width and any increase in latter will increase the amount of noise passed. This imposes stringent design conditions on all the units in the line-up and would be particularly difficult to get and to maintain, at a reasonable price, in the case of a practical home receiver.

Existing Standards

Standard radio broadcasting is at present limited to an upper modulation frequency of 5,000 cycles as a result of the 10,000 cycles spacing of radio channels, but most studio equipment and transmitters are capable of transmitting up to 10,000 cycles or higher. However, satisfactory reception with this wide band is not generally possible in the evening, because of "monkey chatter" from adjacent channel stations, so that a restriction in frequency response in the receiver is in

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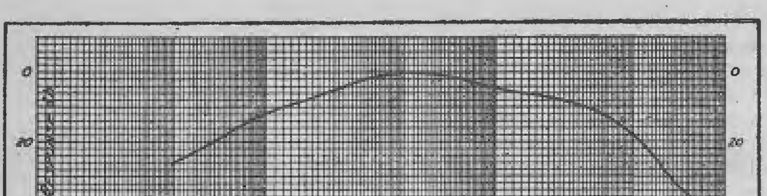


Fig. 4.—Aural frequency response, young listener seated at 45 degrees to loudspeaker.

HIGH FIDELITY

(Continued)

such case actually desirable.

Whether or not we can make full use of a complete audio spectrum depends, in the final analysis, upon the ability of the manufacturers to provide receivers which will satisfactorily reproduce the lower frequencies. Only when this is possible in the average marketable receiver can we make full use of the higher portions of the frequency spectrum and can refer to the system as one of higher fidelity. The average price of a broadcast receiver in 1940, of which many millions were sold, was about $35, and at this price satisfactory reproduction of 50 to 15,000 cycles is not to be expected. The response of home receivers has been found to be substantially as follows:

Small table model	200 to 3,000 cycles
Large table model	150 to 3,500 cycles
Consoles*	100 to 4,000 cycles

* (A few in this class were capable of fair reproduction to 8,000 cycles.)

It must be stressed that power handling facilities in all models were quite limited at the lower frequencies, due to speaker design, so that the lower limit does not actually have the meaning it implies.

Practical Aspects

In an appeal to common sense and practicality in the matter of fixing an audio band width for receivers, it is suggested that the range from 60 to 8,000, or possibly 50 to 10,000 cycles be considered for all types of broadcasting, including frequency modulation. There is very little question in the opinion of those who have devoted their lives to the problems of sound reproduction, that good reproduction over a practical band will provide a better service to the listener than one of controversial and indefinite quality over a theoretically complete audio spectrum. Our efforts should therefore be directed rather towards the provisions of a balanced system of reproduction as fine as we can possibly design and build it, than solely toward extending the upper frequency limits of audibility beyond 10,000 cycles with the possible neglect of other more important factors. It is especially stressed that reproduction at the lower frequencies be investigated and improved, because it is in this direction, the direction of balance as compared with present trends, that we can best provide what unbiased observation and listeners' preference demands.

How can publicising and creating a demand for 15,000 cycle receivers or systems be possibly justified, when a good 10,000 cycle receiver than can be made available to the greater part of the public has not yet been designed? For the sake of technical integrity and the future of the radio industry, let's get down to earth in the matter of high fidelity. We are faced with the prospect of a post-war era in which it is very likely that many claims for new materials, techniques and overall improvements will face the spotlight of public test — and fail. Let us not, therefore, in our enthusiasm make claims that are too difficult, if not impossible, to realise.

"LISTENING-IN" SERVICE OF INTERNATIONAL RED CROSS

To supplement official lists of prisoners-of-war and civilian internees, the International Red Cross Committee's Central Agency for Prisoners-of-war at Geneva started a listening-in service last year. This service functions from 10.30 a.m. until 7 a.m. the next day. Its task is to pick up, as far as possible, certain radio programmes broadcast by belligerent powers giving information and news concerning prisoners and internees detained by them. The most important of these broadcasts are given by Germany, the United States, Great Britain and the Vatican. Programmes on selective receiving sets are followed night and day by specialised staff.

As the information they took down by shorthand was not sufficiently detailed, they are now making records of programmes that are of interest. In general, these programmes consist of lists of names of prisoners-of-war and messages sent by them addressed to their families at home. The records made are carefully listened to and played slowly while their contents are taken down by shorthand, indicating the date, the hour and country of origin, and the wave-length. These reports are then sent to the National Services of the Central Agency, which, in their turn, transmit them to the authorities in the countries interested, always insisting, however, on their purely documentary character and the means by which they were obtained.

REFLEX FOR RESULTS!

Some interesting hints for an enthusiast who likes reflex circuits.

By

Q34129

Sgt. PETERSEN, G. A.

Radio M'ntce Section
L.H.Q. E.M.E. School
Ingleburn

I SUBMIT this small reflex superhet circuit for your approval.

Though by no means a reflex crank, I have spent quite a bit of time and thought over a number of years on this ever-interesting type of receiver.

This is the first time I have actually been satisfied with a reflex set of the small type, that is, with only one I.F. amplifier. It is quite an interstate performer and has surprisingly good tonal quality for a reflex.

Alternatives Available

I fully realise how impossible it is to obtain 12A7's, but I have also used the same circuit as far as the reflex section and mixer are concerned and just a normal 6F6G output, 5Y3G rectifier and normal power supply, with, of course, an electro-dynamic speaker. In all cases the greater ease of control and improvement in tonal quality is evident.

The circuit is fairly straight forward except for the volume control section and power supply.

The Circuit

It can be seen that the EBF2G grid will receive an A.V.C. voltage via the volume control, the usual coupling condenser being omitted, the amount of voltage depending on the position of the moving arm of the volume control pot. The action is such that it is impossible to tune even the most powerful station to overload point of the reflexed stage.

Warning Words

I could probably write pages on this particular part of the circuit but I'll be content with just a few warning words. I might point out that all components used around this part of the circuit have been carefully chosen after exhaustive tests for optimum performance and, are quite critical. Also, don't try using the volume control pot. as the diode load, with the hope of saving one resistor; things don't quite work out that way.

It will be apparent that for such a set the A.V.C. will need to be as efficient as is possible, hence the use of a 2 meg. diode load resistor, to develop a greater A.V.C. voltage, and feeding the diode from the primary of the second I.F. transformers.

The power supply section is quite sound and is used on quite a few American small sets.

A Handy Tip

The filament transformer can be had from one of the early dynamic speakers which used a 240-12v. step-down transformer and metal rectifier to energise the field. My own transformer, however, was made from an R.C.S. speaker transformer winding rewound with a 12v. secondary, of course.

This particular set is quite a midget, being only 7½in. long by 6½in. high and 5in. deep, outside measurements of the cabinet, which is constructed of Masonite, dovetailed and glued and covered with green imitation leather. The tuning control runs over the volume control shaft. The dial is a 3in. vertical edge-lit arrangement with stations marked on. All this had to be, of course, of workshop manufacture and was only done to keep the size down.

This set has been operating in Townsville, Brisbane and Sydney, with excellent interstate reception in all cases.

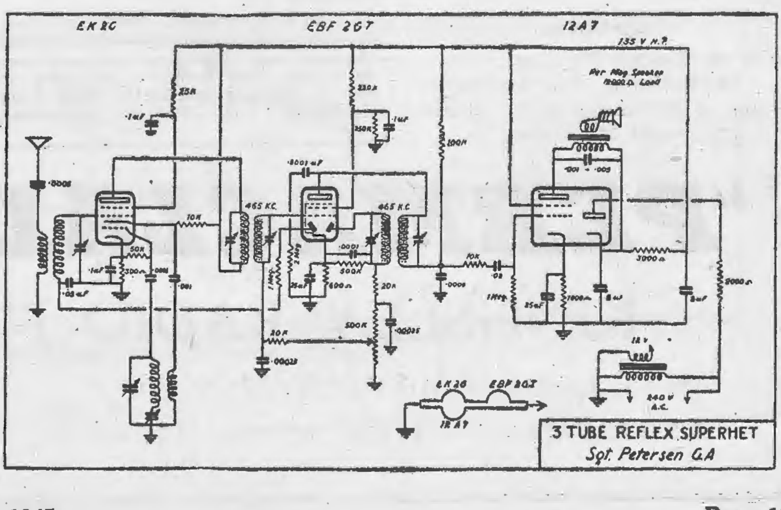
Except for stressing the usual care that is necessary with construction of receivers directly connected to the mains and mentioning the interesting fact that the total power taken by the receiver will not turn the power meter over, being less than 11 watts.

• • •

At Westinghouse Lamp Division, the steel piece previously used to support a wire tube coil while it was being welded has been replaced by a tiny piece of uncooked spaghetti which can be readily burned out later. This step has reduced by 75 per cent. the time required to assemble filaments for certain tubes and also has reduced the need for critical steel.

• • •

Latest X-ray equipments use a high-tension voltage of two million volts. They can be used to examine the inside of heavy metal castings and forgings.



3 TUBE REFLEX SUPERHET
Sgt. Petersen G.A

A HANDY TESTER DESIGN

Multi-Meter arrangement with high medium range

MOST ohmmeters suffer from the disadvantage that their range is extremely limited, especially if readings at the extremities of the scale are to be avoided. The instrument about to be described, as well as measuring the usual ranges of D.C. volts and milliamps, has a reliable range of from ½ ohm to 10 megohms, even though it employs the conventional 0-1 milliameter.

By
65595
Cpl. WHITE, J.
Group 668
R.A.A.F.
Bowen, Q.

Four voltage ranges are available: 0-10, 0-100, 0-500, and 0-1,000 volts, together with five current ranges: 0-1MA, 0-10MA, 0-100MA, 0-500MA, and O-1A, but, of course, these may be varied to suit the individual constructor.

The Ranges

Resistance measurements are covered in three ranges: ½ ohm to 100 ohm, 100 ohm to 50,000 ohm, and 50,000 ohm to 10 Megohm, so no trouble is encountered through cramped scales.

As far as voltages and current ranges are concerned, the circuit is quite conventional, R6, 7, 8 and 9 being the usual multipliers, and R10, 11, 12 and 13 the shunts. The spare contact on the switch (S3) is used when the 0-1 MA range is required, and the switch must be left in this position or on one of the voltage contacts while all resistance measurements are being taken, otherwise the meter sensitivity will be reduced by the shunt connected across it and very serious errors will result.

Ohmmeter Section

The ohmmeter is of the shunt variety on both low and intermediate ohms. S2 must be open, S1 closed and S3 on one of the voltages or on the 1MA position. R4 is the zero adjust rheostat and is varied until full-scale deflection is obtained with the test terminals open.

If the resistance to be measured is less than 100 ohms it is connected directly across the meter and provides an additional path for the battery current. R5 is used to give the intermediate range resistors between 100 ohms and 50,000 ohms are paralleled with the meter and R3, thus enabling higher ranges to be read. A point to be watched is that S1 must be open at all times that the meter is not in use, otherwise there will be a steady drain on the 9 volt battery.

High Tension

A 450 volt supply is required for the high range, and this is obtained from a midget power supply. The transformer is only required to deliver approximately 450 volts at a little over 1 mil.; half-wave rectification is used, and here we utilise whatever tube we have on hand, and tie all the elements except heater and cathode together to form the plate. In the original instrument a type 27 was used, but any triode can be pressed into service providing its correct heater voltage is obtainable. A directly-heated tube can be used here if desired, in which case the positive input to the filter would be taken direct from the filament.

C1 is used to give some degree of filtering. As capacity is not critical, anything in the vicinity of .1 uf suffices, but it must be of the high voltage type, 450 volts at least and preferably 600 volts.

R1 and R2 form a voltage divider network across the output of the rectifier. R1 should be in the vicinity of 250,000 ohms and R2 should be varied until full-scale deflection can be attained with R3 approximately half scale. When making this adjustment the common negative and the high ohms terminal must be shorted, as the instrument is now a series ohmmeter.

Calibration

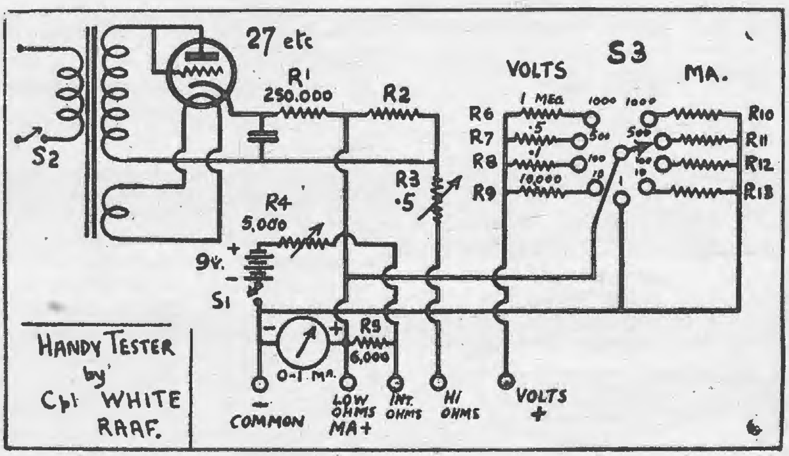
Calibration is best done by carefully removing the scale from the meter, turning it over and redrawing the 0-1 M.A. scale on the back. Underneath this it can be marked 0-10, 0-100, 0-500 and O-1,000. These graduations can then be used for both voltage and current.

Accuracy

The voltage scale will be accurate enough for all practical purposes providing good-quality resistors are used as multipliers, and the shunts may be adjusted as follows.

Obtain a dry cell and a variable resistor so proportioned that 1 mil. is easily obtained. That means that if a single 1.5 volt cell is used, a variable resistor greater than 1,500 ohms must be used. Connect these in series and, with the meter on the 1 mil. position, connect them to the common negative and M.A. + ter-

(Continued on page 28)



A SHORT COURSE IN RADIO

Shunt Resistors — Power Generation

PART 2

SHUNT resistors are used widely in current measuring instruments so that a known proportion of the current will be shunted around the meter; by using suitable values of shunt resistors it is possible to greatly extend the range of the meter. By multiplying the range of the meter by 10 or any of its powers it makes it unnecessary to perform calculations to take readings. Thus, if the current reading on the meter showed 2 amps. and is fitted with a multiplying shunt of 10, the actual current flowing would be 2 × 10, which is 20 amps., and so on.

The value of the shunt resistor may be calculated from ohm's law, however a formula has been derived from this law which simplifies the calculations:—

$$Rs = \frac{Rm}{n - 1}$$

where Rs = desired shunt resistance
n = desired full scale reading ÷ present full scale ing
Rm = Internal resistance of meter

Example.

It is required to convert a 0-1 mA meter, with an internal resistance of 20 ohms to read 0-10mA.

thus $n = 10/1 = 10$; $Rm = 20$

$$Rs = \frac{20}{10-1} = 2.222 \text{ ohms.}$$

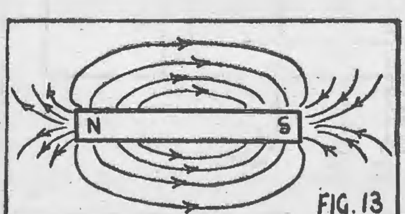


FIG. 13

When resistances are connected in series-parallel as in Fig. 11, the simplest manner in which the total effective resistance of the circuit may be calculated is to first add the series resistances in each branch, so it would be first necessary to add R1 and R2 together, then total R3, R4 and R5 and then, in effect, we have two resistances connected in parallel to which the usual formula may be applied.

Electrical Power

The "watt" is the practical unit of power and is denoted by the letter

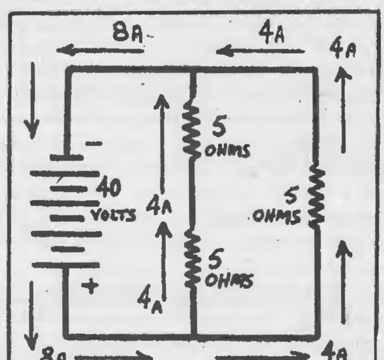


FIGURE 12

W and may be calculated from the formula:
W (watts) = E (volts) × I (amps)

So if a pressure (EMF) of one volt is causing a flow of 1 amp., which incidentally infers a resistance of 1 ohm, the power being expended is exactly 1 watt.

Because of the relation between E, I and R given by Ohms law, power in watts can be defined in two ways additional to the formula given above. From Ohms law we know that $I = E/R$. Substituting in the equation for power given above, we obtain $W = E \times E/R$, thus $W = E^2/R$.

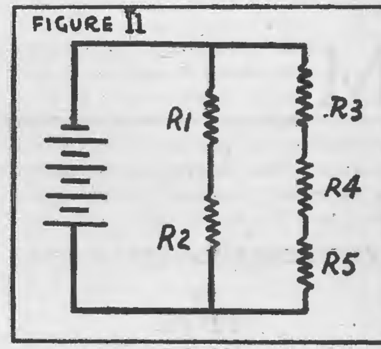


FIGURE 11

Again as $E = IR$, $W = I \times IR$, or $W = I^2R$.

When a power of 1 watt is consumed for a period of one hour, the amount of energy taken is a unit called a "watt-hour." Similarly, if half a watt is consumed for a period of two hours it is evident the energy taken is still a watt-hour.

A "kilo-watt-hour" corresponds to a power of 1,000 watts developed over a period of one hour.

It is often required to calculate the amount of power a resistance will be required to dissipate. Suppose a 450-ohm resistor is required to carry a current of 50 milliamps, what should be the resistor's power rating in watts? In this case the formula $W = I^2R$ is used, remembering that milliamps must be divided by 1,000 to bring them to amps to make the calculation correct.

$$W = \frac{50}{1000} \times \frac{50}{1000} \times \frac{450}{1} = 1.125 \text{ watts.}$$

To ensure an adequate margin of safety, a 2-watt resistor should be used.

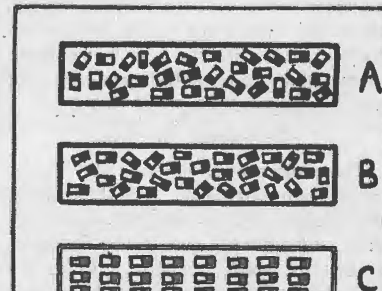


FIG. 14

FUNDAMENTALS -- Part 2 -- Start Now!

Conductance

The unit of conductance is the "mho" and it is the measure of the ease which a conductor will allow a current to flow through it; so it may be defined as the reciprocal of resistance.

Conductance is represented by the symbol "G," so that $G = I/R$, the opposite of Ohms law.

Kirchhoff's First Law

At any junction of resistances, the sum of the currents flowing towards the junction is equal to the sum of currents flowing away from it.

As an example of this law Fig. 12 is used, and by a simple calculation the effective resistance connected across the battery is 5 ohms, and with the aid of Ohms law can show that the current flowing from the positive terminal is 8 amps. As the two branches offer the same resistance, 10 ohms each, to the current, half the current, 4 amps, will flow through each branch. Where the two branches are connected at point A the current flowing towards the negative terminal is equal to $4 + 4$ amps, so that the current flowing towards A is equal to the current flowing away from it.

The above merely explains that electricity cannot accumulate at any part of a circuit.

Magnetism

We have all seen the effect of bringing a horseshoe or bar magnet in the vicinity of a piece of iron or steel; it appears as if the piece of iron were drawn to the magnet by an invisible length of stretched elastic. The piece of metal is said to have come under the influence of the magnetic lines of force and is thus drawn to the magnet. Fig. 13 shows the lines of force of a bar magnet, and can be seen to leave the magnet at the north pole and re-enter it at the south pole.

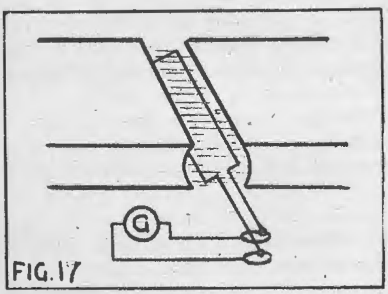


FIG. 17

One of the laws of magnetism is "like poles repel, unlike poles attract each other," so that if the north pole of one magnet is brought in the vicinity of the north pole of another they will tend to move away from each other; if the north pole of a magnet is brought into the vicinity of the south pole of another magnet they will attempt to draw closer to each other.

Molecular Theory

It is believed that each molecule is in itself a magnet, but in a piece of metal which shows no signs of magnetism the molecules may have their poles pointing in any direction and will cancel each other out.

In a magnetised substance, it appears that the majority of the molecules have their axes pointing in the same direction, so their magnetic fields will be additive.

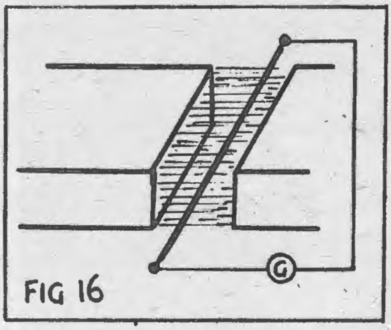


FIG 16

When a substance has been magnetised to "saturation point," that is when it cannot be made to produce a stronger magnetic field, all the molecules will have their axes pointing in the same direction, Figs. 14 (a), (b) and (c) illustrate these conditions.

When an electric current is passed through a substance it has the effect of making the axes of molecules lie in the one direction, thus a magnetic field will be produced around the conductor and is shown in Fig. 15a, and obeys the same laws as a bar magnet.

If an insulated wire is wound in the form of a coil or solenoid it will exhibit a magnetic field similar to a bar magnet as illustrated in Fig. 15b, when an electric current is flowing through it.

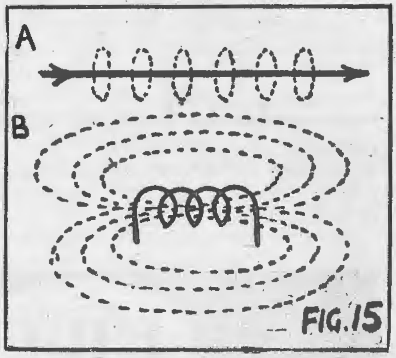


FIG. 15

Reluctance

Reluctance in magnetism is similar to resistance in electricity and is the opposition of a substance to the creation of a magnetic flux in this substance. Reluctance is denoted by the letter S and is measured in oersteds, which is defined as the reluctance of one cubic centimeter of vacuum, however, for most practical purposes is taken of air.

Permeability

Substances such as iron have the ability to produce a flux density hundreds of times greater than air with the same magnetising effect applied, and permeability is the ratio of the ease which a magnetic field may be formed in a substance to that in air.

Permeability is denoted by the symbol u and may be described as the flux multiplying property of a substance.

Retentivity

Retentivity is the ability of a magnetic substance to retain its magnetism after the magnetising force has been withdrawn.

A magnetic substance with a low value of residual magnetism has a low retentivity, while a substance that has a high value of residual magnetism is said to have a high retentivity.

Iron has a low value of retentivity; the harder steels such as

(Continued on next page)

FUNDAMENTALS
(Continued)

cobalt have very large values of retentivity.

Hysteresis

Hysteresis is the inability of the magnetisation to keep up with the magnetising force and is due to the retentivity of the substance and represents a loss of power, as an opposing magnetising force has to be applied to overcome this lagging effect. The lost energy is expanded in heating the iron core.

Alternating Current

Up to this point we have only considered currents generated by chemical means, which are direct currents where there is a steady electron flow in one direction only, as opposed to alternating currents, where not only do the electrons reverse their direction of flow but the voltage and current are continually rising and falling.

If we were to get a very strong horseshoe and pass a conductor through the magnetic lines of force at right angles to them and if this conductor had a sensitive electrical indicating device connected across it, as illustrated in Fig. 16. In this case the indicating device is a galvanometer and its needle is deflected as the conductor cuts the magnetic lines of force, disclosing the fact that an electric current is generated. If the conductor is made to cut the lines of force, still at right angles to them, but in an opposite direction to previously, the galvanometer will once again indicate that an electric current is being generated but in a direction opposite to the first current.

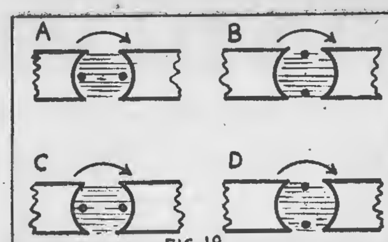


FIG. 18

If the conductor were moved through the magnetic field parallel to the lines of force, no deflection would be noted on the galvanometer, so it is apparent that the conductor must cut through the lines of force before a current is generated.

A formula has been evolved from which may be calculated the value of the induced EMF (volts):

$$EMF = \frac{\text{Total No. lines cut}}{\text{Time taken in secs.}} \times \frac{1}{10^8}$$

The Alternator

If a loop of wire is revolved at a constant speed in an intense magnetic field, as shown in Fig. 17, an EMF of equal and opposite value will be induced in both sides of the loop, as these sides are connected in series by the end piece; the induced EMF will be double that induced in one side of the loop.

At the instant the loop is in the position shown in Fig. 18(a) it is parallel to the lines of force, and is this position, we know, will not induce an EMF in the loop; as it begins to traverse its first 90° to the position in Fig. 18(b) it will begin to cut lines of force and as it approaches the second position, so the number of lines of force that it is cutting will increase until this second position is reached where the loop is at right angles to the lines of force and, as we have already discovered, in this condition the magnitude of the induced EMF will be its greatest; it should now be evident that as the loop rotates from the first position to the second so the amplitude of the induced EMF gradually increased from zero to maximum, in step with the increasing number of lines of force being cut.

The loop will now begin to traverse the second 90° to the position shown in Fig. 18(c), as the loop approaches this third position, so the number of lines that it is cutting, per unit time, is reduced until it reaches this third position, where it will once again be parallel to the lines of force where the induced EMF will again be zero, so the reverse action has taken place to when the first 90° was traversed. When the loop travelled from the first position to the third, the induced EMF increased from zero to maximum and then decreased back to zero.

The Cycle

When the loop travels through the next 90° to the position shown in Fig. 18(d), the side of the loop that was cutting the lines of force downwards is now cutting them upwards, and the side that was cutting them upwards is now cutting them downwards, so that the EMF's induced in them will now be in an opposite direction and the one that was positive is now beginning to become more negative, until it reaches the fourth position where it is then maximum negative, and as it then proceeds to the position shown in Fig. 18(a) it becomes less negative until it reaches this position, which is where it started from.

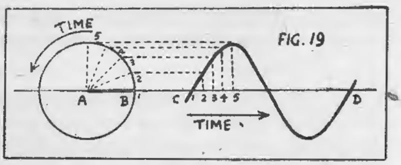


FIG. 19

From the cycle of events described it is possible to project a curve and the manner in which this is done is illustrated in Fig. 19. The line AB represents a conductor that is rotating at a constant speed in a magnetic field. The line CD represents time, and any convenient units may be used; on to this line the curve is projected. For the purposes of plotting the curve we will divide the line into sixteen equal parts, so that will give us four

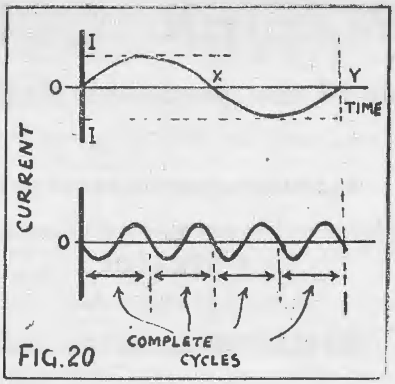


FIG. 20

points for the plotting of each 90°. We will only describe the first 90°, as the other 270° are plotted in a similar manner.

The 90° AB describes is divided into four equal parts and is projected over the corresponding point on CD. We can see that position 1 will fall on CD, so will be zero. Position 2 of AB will fall above 1 and to the right of 1 on CD; position 3 of AB will fall above position 2 and to the right of 2 on CD, and the same thing takes place with 4 and 5. This process may be carried out through the whole cycle and a curve as illustrated in Fig. 19 will result; this is known as the "sine curve." This curve and variations of it play a most important part in radio theory that is to follow, so it is suggested that the reader go over it until an understanding is obtained.

Frequency

The sine curve as shown in Fig. 20

(Continued on page 24)

THIS AMPLIFIER COMPETITION

Further details of the proposed Melbourne contest

By

J. STRAEDE

B.Sc., A.M.I.R.E. (Aust.)

LAST year, when the A.R.D.X. Club prepared to run their contest for the amplifier that would sound best to three selected judges, the writer thought what a good thing it would be if amplifiers were judged on a points basis to determine their all-round usefulness. A prize was offered to the A.R.D.X. Club (by D. J. Collins, A.M.I.R.E., and the writer) for such an amplifier, but, alas, all their arrangements had been made. Now that their contest is over, here's another one to keep the ball rolling.

This coming competition is being run for three main reasons:

1. To promote interest in amplifier **design** as well as in amplifier construction.

2. To find the technical properties of an amplifier that appeals to the listener.

3. To find out what factors are favoured and what neglected by the average home-builder.

Reason No. 1

The writer feels that home-building will come into being again after the war, but hopes that in the meantime the enthusiast will put his spare time into learning how to design an amplifier, how to vary it bit by bit, until he gets good results. In order to cater for the not-so-well-off enthusiast, provision is made in one section for the cost of building to be taken into consideration.

Reason No. 2

No one seems to be absolutely certain as to what technical factors are most desirable in an amplifier as regards the pleasure of the listener. Automatic volume expansion is praised—and condemned. Wide frequency response, likewise. Well, we'll find out. It is expected that most entrants will enter in both sections, so we'll see how an amplifier of a certain type is liked by the audience. This contest should be a particularly valuable one in that it will yield a fair amount of scientific data and settle a few highly and explosively-argued questions.

Reason No. 3

Does the homebuilder become like the racing motorcyclist — performance at the expense of reliability (and long life)? Or does he consider it better to run all components at 50% of their rating in order to save expensive replacements?

Other questions to be settled are: Prevalence or otherwise of very-portable amplifiers, the number of uses to which the average homebuilt job can be put, etc.

How the Contest Will Be Run

All amplifiers in Section A will be played in the same hall and under as nearly as possible the same conditions. Probably from five to seven amplifiers will be tried out in the same "heat." The audience will not be told the owner, power or position of any of the amplifiers, and all loudspeakers, baffles, etc., will be set up beforehand.

If records were plentiful, then two definite records would have been selected, and the same ones used for all amplifiers. However, two fairly difficult **types** of records have been specified and it is probable that any sound system capable of dealing with both of these will handle any modern record. If any enthusiast is desirous of demonstrating how good his amplifier is, on some other record (or how good the record is!), he will be able to try it out after the voting. No jam sessions!!

Possibly after the final winner has been decided, a short programme of selected records may be run through (as an antidote for the audience).

The Technical Section

Here again, there will be preliminary judgings, held at the same times

(Continued on page 24)

BRITISH STANDARD WARTIME SETS

Details of Broadcast Receivers for Civilians

According to a statement from the Radio Manufacturers' Association, a quarter of a million of the long-promised "standard" broadcast sets are to be made during the next twelve months. There will be two models of the Wartime Civilian Receiver, as it is officially called: an AC set costing £12/3/4 complete, and a battery version at £10/19/-, exclusive of batteries. Prices incude purchase tax, and distribution will be through normal trade channels, but, as the sets are produced by co-operative action of the industry they will not bear the names of their individual makers.

Both sets cover the 200-560-metre waveband only, and are fitted with 6½in. permanent-magnet speakers. The AC model, for 195-250v., 50 c/s only, has a 3-valve (plus rectifier) circuit, with frequency-changer, IF amplifier, a Westector as second detector and pentode output. Delayed AVC is included. In the battery version, 2-volt valves are used throughout; the first two function as frequency-changer and IF amplifier, while the third is a double-diode-triode providing rectification, AVC and AF amplification; the output valve is a pentode.

It should perhaps be noted that, as the receivers are subject to purchase tax, the popular practice of referring to them as "Utility" is incorrect.

—"Practical Wireless" (Eng.)

CATHODE RAY TUBES

Theory and practice of the Oscilloscope

THE cathode ray tube is a most useful and interesting device as it enables us to examine directly and visibly electrical and radio phenomena that would otherwise require tedious readings, plottings and mathematical calculations, and its use in conjunction with other equipment has been very extensive during this war and its use in the post-war world will undoubtedly be many and varied.

The envelope of the tube is glass, cylindrical in shape but opening out at one end so a screen of usable dimensions will be formed.

Essential Features

The essentials of a cathode ray tube are a source of electrons, some method of focussing this emission and increasing its velocity so it will cause a fluorescent glow upon impinging a sensitised screen at the end of the tube — also a method of deflecting this electron beam.

There are two methods of focussing the beam — gas focussing and electro focussing; the latter may be further subdivided into electro-magnetic and electrostatic focussing.

The production of the electron emission is the first step, so we will start here and work forward. In the gas focussed or "soft" cathode ray tube a filament type of emitter is used similar to a battery receiving valve and is coated in a like manner with one of the rare oxide earths. The electro-focussing tube uses the indirectly-heated cathode which is also coated with a similar electron-emitting substance.

Regulating Grid

With both varieties of tubes a small metal cylinder is fitted concentrically to the emitter illustrated in Fig. 1; this cylinder is called a grid, wehnelt shield or modulator, and is for the purpose of regulating the number of electrons advancing to the focussing electrodes — the higher the negative potential on the grid, with respect to the emitter, the fewer the electrons that will be able to pass through it, so may be used to control the brilliancy of the spot on the screen—it assists the focussing in that it projects the electrons in a broad beam. As the grid is so close to the emitter and negative to it, it discourages the emission of electrons from the side surfaces, so most of the emission comes from the end of the cathode.

Focussing

In the soft cathode ray tube an inert gas such as helium, neon or argon is introduced into the envelope at very low pressure, which results in an automatic focussing of the electron beam and permits the use of comparatively low operating voltages.

When the electrons pass from the grid they are attracted to the anode, Fig. 2, which also consists of a metal cylinder and is several hundred volts positive to the filament, which gives the electron beam sufficient impetus to cause the flourescent screen to glow at the point of contact. The velocity of the electron beam upon hitting the gas molecules is sufficient to release electrons from them turning them into positive ions which have a very much greater mass than the electrons, so that these ions tend to remain in a beam and, being positive, will attract the electrons to this core, causing them to form into a narrow pencil.

Definition

The degree of focussing with this method is considerably better than in the hard tubes, but suffers from the disadvantage that, owing to the comparatively large mass of the beam, the spot becomes diffused

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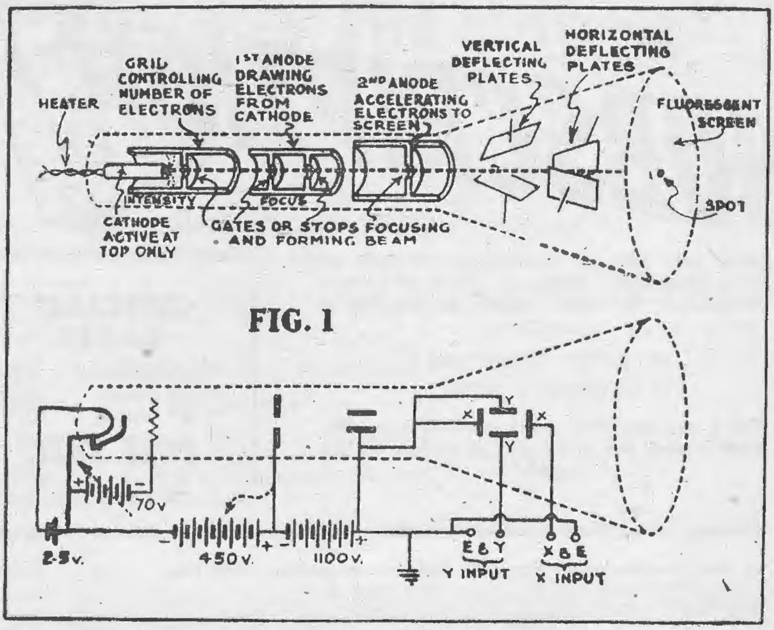


Fig. 1.—The sketches above show the internal arrangement of the R.C.A. 906 type cathode ray tube. Note that in general practice, the second anode and not the cathode is earthed. This allows the deflecting plates to be near earth potential without decellerating the beam. Also note the connections made inside the tube.

C.R. TUBES
(Continued)

when the deflection frequency is raised above about 10 kc/s.

The coated filament of the emitter is subjected to a bombardment of positive ions and it is not particularly suitable for this treatment, which will in due course lead to its disintegration, so its life is considerably less than the hard tube.

The grid is connected to a point on the filament so that focussing and intensity variation may be carried out simultaneously by the filament rheostat. If the emission is too great the spot will be wide and out of focus, and if too little the spot will not be bright enough.

Electron Optics

With electrostatic focussed cathode ray tube the focussing is carried out by two or more specially-shaped anodes arranged along the path of the electron beam. The design of these anodes comes under the heading of electron optics, which, like the theory of all optics, is a study on its own. However, the object of the anodes is to change the electron beam from a diverging into a converging one, so that it will be in sharp focus upon impinging the sensitised screen. This is caused by applying a potential difference of, say, 300 volts to the first anode and one several times greater than this to the second anode, causing electrostatic fields to be set up which focus the beam; this is not only dependent on the position of the anodes but the ratio of the voltages applied to these anodes as well. It is usual to keep the second anode at its fixed high voltage and to bring the beam into focus by altering the voltage applied to the first anode. The electrons comprising the beam, being of a like charge, tend to repel each other, which causes the spot at the point of focus to be slightly diffused; this may be partially overcome by increasing the anode voltage.

To focus the beam with an electromagnetic field, a solenoid coil is placed around the neck of the envelope after the accelerating anode.

Accelerating Anodes

The magnetic field set up by the solenoid imparts a spiral motion to the electrons, causing them to arrive at the same spot on the screen. The size of the spot appearing on the screen may be varied by altering the position of the solenoid with respect to the accelerating anode—the further from the anode the smaller the size of the spot.

This type of focussing suffers from the disadvantage that power is required to energise the magnet,

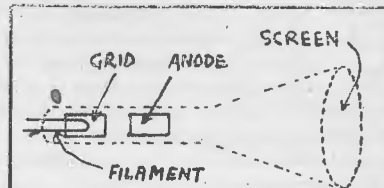


FIG. 2

but on the other hand it has simplicity of construction.

Flourescent Screen

Before considering how the electron beam is deflected, we will have a look at the sensitised screen. This consists of a white chemical powder deposited at the end of the tube on the inside surface. The electrons of the beam will hit the screen with a very high velocity, as high as 15,000 per second, and at this point the screen will emit a flourescent glow. If the focussed spot is allowed to remain stationary on the screen for any length of time the screen will be "burnt" at this point and will suffer a permanent defect, as this point will no longer fluoresce—when not moving, either the intensity of the spot should be reduced or defocussed to prevent this burning.

Control of Colour

Several different types of fluorescent powders are used on the screen of the tube, each with its own special characteristics.

Willemite (zinc silicate) emits a bright green glow when the electron beam impinges on it and has a fairly rapid decay, which means that it soon loses its glow after the beam shifts to another position.

Zinc phosphate has a long afterglow and it may be visible for as long as a quarter of a second after the beam has passed on to another position, and is characterised by its red glow.

For photographic purposes the blue glow emitted by cadmium or calcium tungstate is especially suitable and has a particularly rapid decay.

It is quite possible to obtain a trace of practically any colour, and the ones just given, together with white and sepia, are quite common. Much work has been done with these powders for television tubes.

Deflecting Systems

Up to the present we have seen how the electrons are emitted, controlled and focussed and when impinging a sensitised screen cause it to glow at that point, and we will now consider the methods employed that apply equally well to both hard and soft tubes, to cause the beam to deflect and hollow the variations of the currents under examination.

It should be kept in mind that the electrons are minute particles of negative electricity and as such will be attracted to a positive field and repelled by a negative one.

Electrostatic Deflection

For this type of deflection two sets of plates are inserted inside the envelope after the final accelerating anode; the two pairs of plates are fixed a short distance apart, so one pair is in a plane at right angles with respect to the other. Without any voltages applied to these plates the focussed electron

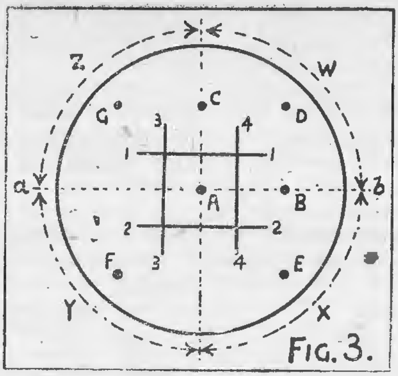


FIG. 3.

beam should impinge the screen at its centre.

The two plates that are mounted horizontally will deflect the beam vertically, so are known as the vertical deflection plates (VDP), while the plates that are mounted vertically will deflect the beam horizontally and are known as the horizontal deflecting plates (HDP).

Considering one pair of plates, either pair, if a potential difference is connected between them, the electron beam (negative) will be attracted to the positive and repelled by the negative plate, deflecting the beam; if the electrical connections to the plates are reversed the beam will be deflected an equal amount in the opposite direction. The amount of this deflection is dependent on several factors—it is natural the higher the P.D. between the plates the greater will be the deflection; the velocity at which the electrons are travelling is also a factor that determines the amount of deflection for a given deflecting force — the higher the velocity of the electrons the greater the deflecting force required to deflect the beam to a given degree.

Electromagnetic Deflection

The explanation about to be given for electrostatic deflection applies equally well to electromagnetic deflection or a combination of the two two as is sometimes used.

In Fig. 3 a screen of a cathode ray tube is shown, 1 and 2 represent-

(Continued on next page)

C.R. TUBES

(Continued)

ing the vertical deflecting plates; 3 and 4 the horizontal deflecting plates. When no voltages are applied to either pair of plates the electron beam will impinge the screen at A, the centre of the screen. If a P.D. is connected between 3 and 4, negative to 3, positive to 4, the spot will fall somewhere along the diameter ab, to the right of A, and we will presume that the deflecting force is sufficient to make it fall at position B. The current to the HDP is now switched off and an equal voltage is applied to the VDP—1 positive, 2 negative—the spot will then take up its position at C. The voltage to 3 and 4 is again switched on so that now there are two deflecting forces acting on the electron beam and the spot will take up its position at the point D. By varying the voltages applied to the two pairs of plates it is possible to make the spot take up a position anywhere in quadrant W.

Locating the Spot

If the polarity applied to 3 and 4 is kept unchanged but that to 1 and 2 is reversed so 1 is now negative and 2 is positive, the spot will now take up its position at E, and by varying the potentials on the plates the spot can be made to take up any position in quadrant X.

The polarity to 3 and 4 is now reversed so that 3 is positive and 4 is negative; 1 is still kept negative and 2 positive. The spot will take up a position at F and likewise may be made to take up any position in the quadrant Y.

To get the spot to fall at position

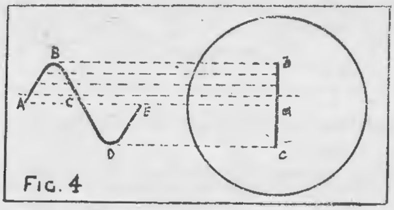


Fig. 4

G in quadrant Z, 3 is positive, 4 negative, as for the quadrant Y; 1 is made positive and 2 negative as was required to make the spot fall in the quadrant W. It is now evident that by applying suitable polarity and potentials to the two pairs of plates it is possible to make the spot fall anywhere on the screen.

Fundamental Application

If an alternating current following the sine curve is applied to the HDP, the VDP being left disconnected, as in Fig. 4, at the point A of the sine curve the value is zero, so the spot will impinge the screen at its centre (a). The voltage increases until it reaches B; the spot will have travelled from the position a to b. The voltage now begins to fall again and the zero position is again reached, C; the spot will have returned from b to a. The voltage continues to fall until D is reached, causing the spot to travel from a to c. After the point D is passed the voltage with respect to D starts to increase again, until E is reached, which is again a zero value, so that the spot will return from c to a.

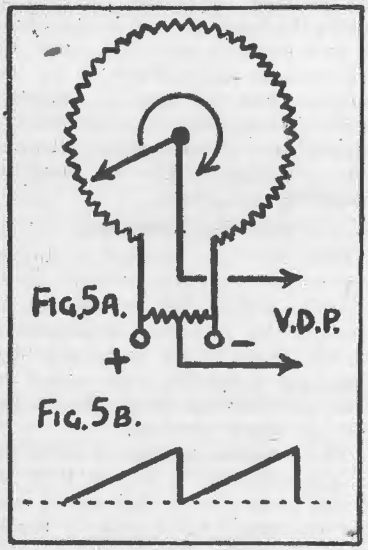
Persistence of Vision

If the frequency of the alternating current were sufficiently slow, the spot could be observed travelling from one position to the other; if, however, a fairly high frequency is being examined, say, 50 cycles per second power supply, the pattern on the screen will appear as a straight line, bc; this is due to the persistency of vision and the after-glow of the fluorescent powder to a much less degree.

In most applications it is desirable that the trace takes the form of the cycle applied to the plates, so a method has been devised that enables us to do this and view the curve on the screen.

To show the theory of this method

we will apply a low frequency alternating current to the HDP; to the VDP we connect the circuit shown in Fig. 5a, which is known as the time base. The wave form of the output of such a device will be somewhat similar to that shown in Fig. 5b, and if it is connected to VDP (Fig. 6) so it will start from zero at the same instant as the A.C. current cycle connected to the HDP is at its zero position and reaches position 2 the same instant the cycle is complete, it will be at zero again in time to sweep the next cycle across the screen in a like manner; the speed at which this is done causes the pattern on the screen to appear stationary and as one complete cycle.



To obtain a complete pattern it is necessary that the frequency of the alternating current is an even multiple of the frequency of the time base circuit—twice the frequency, two complete cycles will appear on the screen; three times the frequency, three cycles and so on. This type of time base circuit is seldom used in practice and a more convenient electronic method has been devised but will not be touched upon here as it is worthy of an article on its own account.

* * *

CHEAP SETS

Already one American manufacturer has announced a post-war plan to produce a four-valve radio set to sell at six dollars, about £2 in our money.

ANOTHER ANGLE ON HIGH FIDELITY

PUBLISHED in the American technical journal "Q.S.T." recently was an advertisement of the National Company, makers of the H.R.O. communications-type receiver, in which the President of the company, William A. Ready, told his personal ideas about the much-discussed subject of high fidelity. This is what he wrote:

"High fidelity" has come to mean the same thing as wide frequency range to most radio men. This can lead to a lot of grief, because wide range is only one of the requirements that must be met. In our experience it is not even the major requirement.

Requirements

We take it that fidelity refers to the ability of a sound system to reproduce the original sound faithfully. The more the reproduction sounds like the original, the higher the fidelity. We think there is not much argument here.

For the reproduction to be a perfect replica of the original nothing must be added and nothing can be taken away. Unless the system can reproduce a wide range of frequencies, something is taken away. The "highs" are missing. Unless the system is free from distortion, something is added. Harmonics are present. In our experience, distortion is more important, and much more difficult to control than frequency range.

As an experiment, we once "souped up" a phonograph so that the upper limit of its range was extended from about 5,000 cycles to about 10,000 cycles. We substituted a wide-range speaker for the previous one, and added compensation by means of filters to extend the range of the pickup and amplifier. It sounded awful, much worse than before we made the changes in fact. This must be a fairly common experience, because a number of people who heard it remarked "That is what you always get when you go in for high fidelity."

As a sequel to this experiment, we rebuilt the amplifier. Triode tubes, operating Class A, were used throughout. The last two stages were push-pull. Transformers of the highest grade were employed, and the output transformer in particular was a husky affair having lots of iron and copper. Great care was taken to make sure that the amplifier was absolutely stable and that the speaker was adequately damped. The pickup was of a special type having linear response to 15,000 cycles. Having done all this, we then inserted a filter with a cut-off at about 5,000 cycles.

With such a cut-off, the system clearly could not be called "high-fidelity," yet the reproduction was so realistic that it approached the spectacular. The attenuation of high frequencies was similar to the loss caused by distance, or by draperies. Someone hearing the system for the first time, without warning, was apt to say, "Who is playing the piano **in the next room?**" The italics are ours.

A Practical Suggestion

We are not arguing against wide frequency range. On the contrary, we think that only a wide range system can do a first-class job. A phonograph pickup will introduce a lot of distortion as it approaches the limit of its range. So if you want to reproduce 7,500 cycles do not use a pickup that just reaches this range. Use one that goes an octave higher, to 15,000 cycles. Then use a filter that cuts off just low enough to take out the distortion in the record, at the limit of **its** range. The same thing goes for radio tuners, speakers, and amplifiers. It may seem wasteful to buy frequency range and then throw it away with a filter. Actually you buy fidelity and throw away distortion. You will hardly believe how good such reproduction can be until you try it.

* * *

ELUSIVE HUM TROUBLE

An American serviceman reports a case where hum was caused in a set by the light from an alternating current lamp falling on a '27 type detector valve. The cure was to shield the valve from light.

It sounds incredible, yet is quite possible, due to the effect on cathode emission by light.

STRAEDE'S CONTEST

(Continued from page 18)

as the heats in Section A, but the public will not be allowed to take part. The three judges, one from RCA Photophone, one from a broadcast station and one from a radio school known all over Australia.

No enthusiast need fear to enter for this section, no matter how big or how small his job and how expensive or how cheap, because all factors including power, portability, and cost of manufacture are considered. In this section there will probably be several minor prizes for amplifiers fitted with the best home-made pickup, the best portable baffle and the one with the most unorthodox circuit.

Possibly some of the novices will wonder what some of the terms (such as inter-modulation distortion) mean. Well, there are two main kinds of distortion — one is called "frequency distortion" and means that notes of some pitches are reproduced more loudly than others. An example of this is a radio fitted with an old-fashioned horn speaker which has a tinny sound due to a few notes around the 500 to 1,000 hertz mark (that is approximately C′ to C″ on the piano), being over-accentuated. Another example is the muffled tone we get when high frequencies are reduced, due to the use of plate-bypass condensers which are too large.

The other kind of distortion is called "amplitude distortion" because it varies with the amplitude or loudness of the music. Soft notes are clear and pleasant, but extra loud notes have an "edge" on them. Closely associated with amplitude distortion is inter-modulation distortion which occurs when two notes are being played at the same time and one or both are distorted. If the two notes happen to be a discord (and therefore not too pleasant, even when not distorted!), they become quite unbearable when distortion occurs.

Some of the points are allotted for flexibility or number of uses to which the amplifier can be put, **but,** if you claim a use, you **must** be prepared to demonstrate it to the judges! Possible uses in expected order of frequency may be: pickup, microphone, electric guitar, laboratory amplifier, oscillator, booster, recording amplifier.

Help For Enthusiasts

Don't be too worried if you've just busted your one-and-only pick-up; the writer will be pleased to lend you his (complete with motor) on the nights of the heats, provided you have a suitable 4-pin socket to take the pick-up plug (No. 4 pin hot, all others earthed).

The maximum output at 1,000 c/s is approximately 1/6 volt RMS or ¼ volt peak (lower than usual) and the response with a load of 90,000 ohms is quite flat (within ½ db) between 250 and 5,500 hertz. There is a gradual rise at each end—to 7 db at 50 hz and to 2 db at 7,000. With 100,000 ohm load and a .0001 condenser, the response is almost dead flat to 6,000 and then trails off sharply.

Late Entries

Originally it was felt that if a person were not enthusiastic to get his entry in on time, then he (or she) didn't deserve to enter. However, there are qiute a number of keen amplifier owners who may have to tear up their built-in baffles to get at the speakers, others may need to borrow cars to carry their equipment, and so it was decided to permit late entries up to the time of starting the first heat, but **please** get your entry in **early.**

POCKET RADIOS

Several radio manufacturers in U.S.A. have announced that they hope to market pocket radios for businessmen and others. There appears to be no limit to the miniaturisation which can be applied to radio components.

FUNDAMENTALS

(Continued)

is one cycle and if it took the revolving conductor one second to produce it the alternating EMF would be said to have a frequency of one cycle per second. Now, if the speed of the conductor is increased so as to produce five complete cycles per second, Fig. 20, it will then have a frequency of five cycles per second.

The human ear has a frequency range of from about 16 to 20,000 cycles per second and these are known as audio frequencies; it is also usual to include the frequencies between 0 to 16 cycles per second as audio frequencies. The frequencies used for the power mains in Australia are 40 and 50 cycles per second. Plans are being made to convert them all to 50 cycles per second.

Frequencies above about 20,000 c.p.s. are known as radio frequencies. As 1,000 cycles is equal to a "kilocycle" (kc), it is more easily expressed as 20 kilocycles per second. When frequencies of over a million cycles per second are reached it is usual to express them in megacycles, thus, if we wished to express 23,950,000 c.p.s., we would say 23.95 megacycles.

Effective EMF and Current

As we are aware, the instantaneous value of the current or EMF varies through the cycle. To obtain the "effective" value of an alternating current it is necessary to compare the heating effect of this current compared to the heating effect of direct current.

This effective value is obtained by taking the instantaneous values of current over a cycle of alternating current, squaring these values, taking an average of the squares, and then taking a square root of the average; owing to this method, the effective value is known as the "root mean square" or r.m.s. value.

The r.m.s. may be calculated by multiplying the maximum value reached in the cycle by .707, thus:

E (r.m.s.) = E (max.) × .707 volts
I (r.m.s.) = I (max.) × .707 amps.

RMS values may be returned to their maximum or peak values by the following formula:

E (max.) = E (r.m.s.) × 1.414 volts
I (max.) = I (r.m.s.) × 1.414 amps.

Average EMF and Current

The verage value is calculated by taking the value of all instantaneous values of half a complete cycle.

The average value of a sine curve may be calculated from the formulae:

E (ave.) = E (max.) × .637 volts
I (ave.) = I (max.) × .637 amps.

(Part 3 of this series will appear in next issue.)

MOVING COIL METERS

The inside information about your Multi-meter

THE multi-meter is undoubtedly the most commonly seen and used piece of test equipment in radio due mainly to its flexibility and comparative low cost —instruments are available with as many as 46 ranges, any one of which is obtained by the flick of a switch.

Accuracy Considerations

The instrument is constructed around the d'Arsonval moving coil meter on which the accuracy of all the ranges are dependent; if this is not accurate, then no matter how much care is taken with the shunts, series resistances, etc., the readings will be no more accurate than the design of the meter.

This type of meter is designed on the electric motor principle and to obtain high sensitivity an intense magnetic field is required; this is obtained by using cobalt steel in meters with a sensitivity of up to 1,000 ohms per volt — if greater sensitivity is required an alnico steel is used, which is about 2½ times more powerful than cobalt.

Constancy

If the calibration of the meter is to remain constant over a period of time it is necessary that the magnet will have unvarying characteristics, for this end the magnet is artificially aged by steam heating.

The magnet usually takes a horseshoe shape and is fitted with soft iron pole pieces shaped to form a hollow cylinder on their inner surfaces, Fig. 1a.

Mechanical Details

The field strength of a magnet is inversely proportional to the square of the distance separating the poles, so as to reduce the permeability of the gap; a soft iron core is suspended in the hollow cylinder by two brass supporting plates. In the space between the poles and the core is mounted a coil in jewel bearings via two spindles, Fig. 1b. To one of these spindles is fixed a pointer, together with two counterbalance weights. The moving coil is wound on an aluminium former with a large number of turns of insulated fine wire.

The Spring

A phosphor bronze spring is mounted on each spindle, which provides a torque as the coil turns and are also used to conduct the current under measurement in and out of the coil. The greater the torsion of the springs the greater the current required to deflect it a certain amount; however, there are fixed limits on reducing the size of the spring to reduce the torsion.

Damping Factors

It is desirable that the meter shall be what is called "dead-beat" or "aperiodic," which means that the pointer comes to rest immediately it reaches the position the deflecting current will cause it to take. The process used to bring about this condition is known as "damping" and the example just given is 100% or perfect damping. The damping is brought about by the aluminium former on which the coil is wound, for, as the coil turns, the former will have Eddy currents induced in it, which according to Lenz's law will produce a force or drag opposing that of the moving coil which in effect is to steady its motion.

If damping is overdone the meter becomes very sluggish in action and may take some time to arrive at its final position — the greater the damping the slower the movement of the needle.

Under-damping is when the pointer oscillates about the final point of rest before taking up its steady position—the less the damping the more oscillations there will be before the pointer comes to rest.

In practice slight under-damping is aimed at so the needle will oscillate for a practically negligible period and almost immediately come to rest.

The Sensitivity

The sensitivity of a meter is usually expressed in ohms per volt —the higher the ohms per volt the greater the sensitivity of the meter —and may be calculated from the following formula:

$$\text{Ohms per volt} = \frac{1,000}{I}$$

I is the full-scale current drain of the meter in milliamperes, thus the sensitivity of a 0-1 milliammeter is 1,000 ohms per volt.

The coil, over the whole of its arc of movement, will travel through a field of uniform flux density, so that the torque that the coil experiences will be proportional to the

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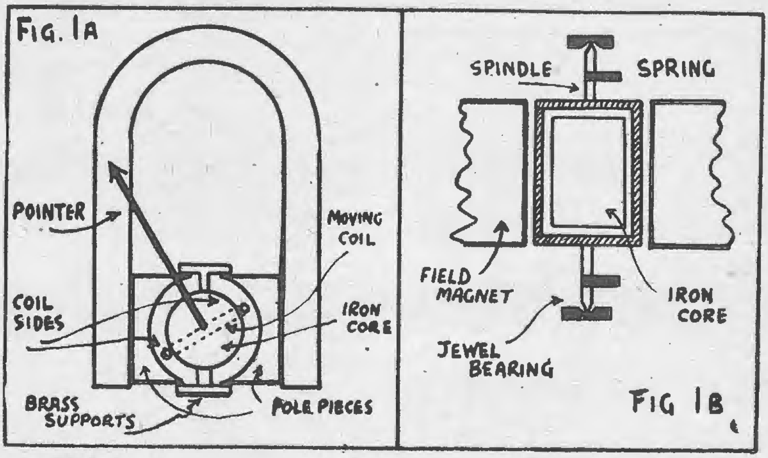


current in the coil. Thus readings over the whole scale are uniform.

The 0-1 milliameter may have its current measuring range extended by the addition of suitable shunt resistances. For these calculations it is necessary to know the resistance of the meter which varys from about 30 to 100 ohms, according to manufacture.

Full-scale Deflection

When a current of 1 m.a. is flowing through the meter the pointer will register full-scale deflection; if a resistance with the same value as the meter is shunted across the meter (i.e., they are connected in parallel) half the current will flow through the shunt and the other half through the meter, which will register .5 m.a.; so now 2 m.a. will have to flow through the circuit to obtain full-scale deflection of the pointer, which means the range of the meter has been doubled. From this a formula may be evolved for extending the current ranges of the meter.

Let the resistance of the meter be represented by Rm; the shunt by Rs; the main current in m.a. by I; the branch currents through the meter and shunt Im and Is, respectively; and it is desired that the meter will measure a current of n times the full-scale deflection; so—

$$I = Im + Is \qquad (1)$$

$$n.Im = I \qquad (2)$$

Substituting n.Im for I in (1)—

$$n.Im = Im + Is$$

Therefore—

$$Is = Im\,(n-1) \qquad (3)$$

The voltage across the meter equals Rm.Im, and across the shunt Rs.Is, which must be the same as they are connected to the same points in the circuit.

Thus—

$$Rm.Im = Rc.Is$$

$$Is = \frac{Rm.Im}{Rs}$$

Substituting in (3) for Is—

$$\frac{Rm.Im}{Rs} = Im\,(n-1)$$

$$Rs = \frac{R}{n-1} \text{ ohms}$$

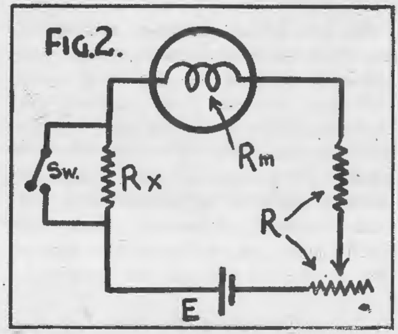
Example: A 0-1 m.a. meter, of resistance 100 ohms, is required to read 0-20 m.a.

$$n = 20;\ I = 20;\ Rm = 100$$

$$Rs = \frac{100}{20-1} = 5.263 \text{ ohms}$$

If the meter is shunted by a resistance of this value and a current of 20 m.a. is allowed to flow through the circuit, 19 m.a. will flow through the shunt and 1 m.a. through the meter, which will indicate full-scale deflection and at lower values of current proportionate intermediate readings. In this example the actual readings on the 0-1 m.a. scale should be multiplied by 20 to obtain the true current flow.

FIG. 2.



Voltage Measurement

We have seen how the 0-1 m.a. meter is capable of reading practically any value of current, and we will now see how it may be converted to measure voltages.

If we were to connect the meter directly across 10 volts the current flowing through it would be limited only by the resistance of the meter which, we will suppose, is 100 ohms, and with the assistance of Ohms law we can see that a current of .1 amp. or 100 m.a. would flow, which is 100 times more than the meter is designed to pass, which is not very beneficial to the meter, and it is necessary to place a limiting resistance in series with the moving coil of the meter, so that when 10 volts is applied across the circuit a current of 1 m.a. only will flow, so that the 10 volts will give just a full-scale deflection. The value of this resistance may be calculated from a variation of Ohm's law:

Rm is the internal resistance of the meter; Rs the series resistance; E the maximum voltage it is required to measure, and I the current; from Ohm's law—

$$I = \frac{E}{Rm + Rs}$$

As I in this case = 1 m.a. =

$$\frac{1}{1{,}000} \text{ amps}$$

So

$$\frac{1}{1{,}000} = \frac{E}{Rm + Rs}$$

$$Rm + Rs = 1{,}000\,E$$

$$Rs = 1{,}000\,E - Rm$$

Example: Convert an 0-1 m.a. meter, with a resistance of 100 ohms, to read 0-10 volts.

$$Rs = 1{,}000 \times 10 - 100 = 9{,}900 \text{ ohms}$$

In actual practice for the voltage scales the resistance of the meter may be ignored and a 10,000 ohm series resistance could be used in the above case. It should be obvious that the above formula as it stands is suitable for the 0-1 m.a. meter, if it was, say, a 0-5 m.a. meter, 200E would have to be substituted in the formula for 1,000E.

Resistance Measurement

A 0-1 m.a. meter may be easily adapted for resistance measurements. Arranging a circuit so when a battery is connected in series with the meter and a resistance which limits the current flow to 1 m.a.; if an unknown resistance is inserted in series with the circuit it will reduce the current, depending on the value of the resistance which may be read on a calibrated scale. We will now show how the calibration is calculated in a practical ohm meter. In the circuit shown in Fig. 2 the battery (E) has a voltage of 1.5 and it is necessary that the resistance (R) should restrict the current flowing through the meter to 1 m.a. when the unknown resistance (Rx) is shorted out of the circuit.

$$E = 1.5;\ Ia = \frac{1}{1{,}000} \text{ amp};\ Rm = 100$$

$$R = \frac{E}{Ia} - Rm$$

$$= \frac{1.5}{\frac{1{,}000}{1}} - 100$$

$$= 1{,}500 - 100$$

$$= 1{,}400 \text{ ohms}$$

This resistance is made up of a fixed and variable resistance, which may be, say, 1,000 ohms, for the fixed resistance and a 500-ohm variable which is adjusted with Rx out of circuit, so the meter will give its full deflection of 1 m.a. When Rx is seriesed in the circuit the current flow will be reduced and may be read from the scale, and according to Ohms law will be as follows:

I is the current flow in m.a.; E is the applied voltage; Rx the unknown resistance; Rm the internal resistance of the meter; and R the current limiting resistance—

$$I = \frac{1{,}000\,E}{R + Rm + Rx} \text{ milliamps}$$

It is necessary to multiply by 1,000 as the current is in milliamps.

To obtain the value of the unknown resistance:

$$1{,}000\,E = IR + IRm + IRx$$

$$IRx = 1{,}000\,E - IR - IRm$$

$$Rx = \frac{1{,}000\,E - I(R + Rm)}{I}$$

Example: An 0-1 m.a. meter, 100 ohms internal resistance, fitted with current limiting resistance of 1,400 ohms and a batter of 1.5 volts, shows a deflection .6 m.a. when an unknown resistance is placed in series with the circuit. What is the value of this resistance?

$$E = 1.5;\ I = .6;\ R = 1{,}400;\ Rm = 100 —$$

$$Rx = \frac{1{,}000 \times 1.5 - .6(1{,}400 + 100)}{.6}$$

$$= \frac{1{,}500 - 900}{.6}$$

$$= 1{,}000 \text{ ohms.}$$

With a few calculations of the type just shown it is possible to calibrate the scale so that resistances may be read directly.

TELEVISION FROM RECORDINGS

Television from recordings is promised by an American Company. Foreseeing that future television programmes will be on the air only a few hours nightly, this firm proposes to supply stations with television disc-recordings to be used for off-time fill-ins. These telerecords could also be played by set owners with a sort of television "phonograph" pick-up. The idea of having recorded television is not new, but up till now engineers have held that the recording of high-definition television would be most difficult.

* * *

PERMEABILITY TUNING

W. J. Polydoroff, a pioneer in early efforts at so-called "permeability tuning," has announced a new method whereby the actual permeability of a core is altered. As at present understood, permeability tuning really amounts to altering the reluctance of a coil by sliding a core through it. The new idea is to alter the permeability of the core by imposing a steady d.c. current to affect the flux.

HANDY TESTER

(Continued from page 13)

minals, making sure first that the resistance is in its maximum position so that the meter will not be damaged. The resistance is then retarded until exactly 1 mil. (full-scale deflection) flows. Switch to the 10 mil. range and adjust R13 for 1/10th full-scale deflection. When this is obtained the resistance is retarded still further until we again have full-scale deflection on 10 mils. The 100 mil. range is switched in and R12 adjusted until once again we have 1/10th full-scale deflection. The process is repeated for the higher ranges except that when the 500 mil. range is switched in R11 it is adjusted for 1/5th full-scale deflection and for the 1,000 mil. or 1 amp. range, R10 is adjusted for ½ full-scale deflection. If at any time during this adjustment it becomes difficult to obtain full-scale deflection, extra cells may have to be added.

Calibration of the ohms scale is now all that is left and on the high and intermediate ranges is best done by connecting in accurate known resistors and marking them on the scale, first of course adjusting the zero-ohms potentiometers.

The low ohms scale may also be calibrated by this means, but if low accurate resistors are not available the following formulae may be used:

$$m = \frac{R}{Rm + R}$$

R = Res. to be measured.
Rm = Internal res. of the milliameter.
m = Meter reading in M.A. with resistor connected.

D.C. SET

(Continued from page 5)

across the heaters if the drain is not the same. 32L7GT is the best bet for a substitute.

It should be borne in mind that this chassis is "hot" and dangerous to handle, so take care. If desired all earthed points can be taken to a common point and direct to the chassis, except maybe through a tubular condenser. This would increase the danger to a great extent. Take care to insulate the gang from the chassis if you use this system. Another important item—make sure that the knobs used on the controls have short grub screws on them as they connect to the control shafts and can give you a nasty shock. "It is better to be safe than sorry." Apart from these precautions, there is very little difference than if you were building a conventional superhet.

Just be careful all connections are as shown on the circuit diagram.

POST-WAR RECEIVER FEATURES

Some opinions from a prominent Radio trade personality

MR. A. FREEDMAN, general manager of Stromberg-Carlson, in an article appearing in a recent issue of "E.R.D.A.," expresses the opinion that the quality of manufacture of the post-war radio receiver will be far superior to the pre-war product.

Mr. Freedman says:

The Communication Industry in this country has, during the past four or five years, produced equipment of which it may well be proud, and the experience gained in the manufacture of equipment upon which the safety of thousands of men has been dependent, will result in radio equipment which will be far more reliable than anything produced in the past.

Cabinet Designs

The post-war trend will be towards mantel models and radio gramophone combinations with consoles assuming less importance than before the war. Apart from greater reliability and better mechanical design, I do not expect to see anything revolutionary. After all, circuit design before the war had advanced to a stage where, under existing broadcasting technique, the listener did get results compatible with what he was prepared to pay for his receiver, and I doubt, apart from the improvements in performance of valves and components, which it would be normal to expect, that there have been any developments of so radical or revolutionary a nature so to change very greatly the radio receiver of the immediate pre-war era. What will actually be released by manufacturers, when restrictions on civilian production are lifted, will depend, to a very large extent, on the Government's policy in allowing manufacturers to prepare for the return to normal production. The radio industry is not faced with a very difficult problem as far as manufacturing reconversion is concerned, but the problem of new designs, and the tooling programme to enable them to be produced, is a difficult one, and one which requires men and time.

I am very much afraid that the immediate "post-war" receivers will be only what the industry can "slap" together to get on the market. In my opinion, the Government should grant manufacturers the permission to begin development of new designs now, even if there is a restriction upon the amount of money which can be spent by each manufacturer for this purpose. This has already been done in America, and, from conversations I have had in America with executives there, I feel fairly certain that manufacturers in England have also been allowed to proceed along similar lines.

Frequency Modulation

Just how Frequency Modulation and Television will affect the "post-war" picture seems to be in every radio man's mind today. In the normal course of events I should say that we would have frequency modulation at a fairly early date and television in a few years' time.

I doubt that Australia can, at the present time, support television on other than an experimental basis.

No one should expect F.M. to supplant our present system. It has not done so in America, and is less likely to do so in Australia. While F.M. transmitters are relatively inexpensive, F.M. receivers, built to incorporate all that F.M. has to offer, require at least 7 or 8 valves, so it is unlikely that F.M. receivers will "swamp" the market. In addition, F.M. converters can be supplied to allow present receivers to be operated either on F.M. or A.M.

I left America very disappointed with television as a near future commercial proposition for Australia, but very much sold on F.M. as an immediate development for this country. I sincerely believe that at the present time F.M. offers the industry the same relative opportunities as the introduction of the first A.C. superheterodyne did in 1931.

Merchandising.

Mr. Freedman can see no radical changes in distribution, but believes there is room for a lot of improvement in selling force in the last link of the distribution chain — the retailer.

A further point made by Mr. Freedman is that our guarantees in the past have been for far too long a period, and the time has come when the industry could well adopt the form of guarantee which is almost universally used overseas, and which limits the warranty to 90 days from date of purchase.

RADIO BEST BEFORE FULL MOON

Radio reception has now been found to vary with the phases of the month, it was disclosed in a General Electric Science Forum address by Dr. Harlan True Stetson, of Cambridge, director of the laboratory for cosmic terrestrial research, Massachusetts Institute of Technology.

A Long Study

Citing the results obtained from data after more than 20,000 hours of observation over two periods of four years each, Dr. Stetson said: "From the study of our data, made on those nights when the moon was overhead, we found radio reception definitely improved from the time of the moon's first quarter to shortly before full moon. After full moon, radio reception deteriorated, but began to improve again from about the last quarter until a few days before new moon. This, of course, is true for a certain peculiar frequency over a certain path we were measuring.

Lunar Effects

However, in observations made when "the moon was below the horizon"— observations made in the dark of the moon —"We found no such effect, where no radiation from the moon's surface could reach the radio waves over the path we were studying," Dr. Stetson pointed out. "The same thing happened in both series of data, except that the lunar effect was more pronounced during the second four years of our data than during the first four years," he declared.

—"Radio" (U.S.A.).

Shortwave Review

CONDUCTED BY
L. J. KEAST

NOTES FROM MY DIARY

A SOLDIER DX-ES

A long informative and very welcome letter from S/Sgt. R. K. Clack reached me a few days ago. Ray is a very keen DX-er and has his little portable with him, and, to use his own words, "I still have the portable you secured for me way back in 1941 and, believe me, it is still giving excellent results. I am using it in conjunction with an inverted 'L' antenna, 50ft long and 20ft high, running due north and south. The location is a good one but local QRN is very high nearly all the time. The success he has had will be shown by a glance at the number of loggings credited to him, which is only a tithe of those he mentions but which, through pressure on space, have had to be omitted.

VICTORY THROUGH AIR POWER

This is the apt title given to an address delivered by Col. Thomas H. A. Lewis, Commanding Officer of Armed Forces Radio Service, on the occasion of the 25th Anniversary of American Radio. He explained how from a very modest beginning just after Pearl Harbour the Armed Forces Radio Service was now presenting 126 programmes per week; 43 different languages and dialects were employed and the 73 top programmes of the four networks, occupying 36 hours, were used in providing amusement and instruction for the Armed Forces. I heard it over KGEX, 19.72 met., at 12.30 p.m. on Friday, 16th February, and again at 8.15 p.m. the same day over KROJ, KGEI and KWIX. A most interesting talk which occupied 28 minutes and crammed full of items that would appeal to radio DX-ers. I am hopeful I can obtain the full text and print it in these columns in next issue.

SAYS WHO?

"I see a paragraph in the last issue of 'ARW' referring to the matter of verifications, or lack of them, from Noumea. You may be interested to know that I have received three veries from this station. Two of them were cards and the other a letter accompanied by a photograph of the studios and their lady announcer. The card is normal postcard size, white with black printing. It gives only the call sign FK8AA, Radio Noumea, 49.92 met., owner-operator, M. Charles Gaveau. Despite the simplicity, I count it as a card well worth having, in view of the fact that they appear to be so difficult to obtain."—Clack. (Of course, it must be some time since they operated on 49.92 met., as the only records I have in front of me are 49.00, 48.90 and their present wave-length of 48.39 met.; but a verification from the station is one to be proud of.)

•

Reception from several 'Frisco stations is spoilt between 6 and 7 p.m. by a bad heterodyne from the BBC transmitters. Three that come to my mind, and on identical frequencies, are: KNBA, 9.49 m.c., by GWF; KGEI, 9.55 m.c., by GWB; and KGEX, 7.25 m.c., by GWI.—L.J.K.

•

"A most interesting verie has come from CE-970, Valparaiso, for my report on 30.82 met. The card was a large one with a map of Chile on the left, on which were located the various transmitters operated by the same network. The address is: Compania Chilona de Comunicaciones, S.A., Radios "La Cooperativa Vitalicia," "La Voz de Chile para toda America," Casilla 37 V., Valparaiso, Chile."—Gillett.

•

"No wonder you thought you were on KROJ, 30.31 met. (or 30.4, as Mr. WBOS calls it). WLWR, or was it 'L,' used to call it 30.35 met. Think some station once said 30.33 met., and am sure it has been called 30.3. WBOS is very fine from 7 a.m. and on Fridays at 7.30 a.m. a most interesting session, 'War Review.' Apart from his closing call, the call has always been 'Westinghouse International Station, WBOS, etc.,' not 'This is WBOS, etc.' "—Gaden.

"Address for reports on NPM, Honolulu, 13.065 m.c., is: The District Communications Officer, 14th Naval District, Honolulu, Hawaii."—Clack.

•

Another to join the KMB brigade is Hugh Perkins, who, when referring to station on 6.02 and 7.57 m.c., gives calls as KMBI and KMBX. However, if I had ever thought call was M, all doubts would have been dispelled on 15th February when, at 5.15 p.m., announcer, in giving balance of February schedules for KNBA, KNBAC and KROJ, said, "KNBA, N as in new." Since then I have received a list from 'Frisco mentioning the N.B.C. stations as KNB.—L.J.K.

•

"Now what is the final letter of the Crosley station on 7.82 m.c., 38.35 met., heard at night? Is it X or S? Most often I think it is X. Not a bad signal at 9 p.m. Have not heard it open or close, but do not think it is on for very long."—Gaden.

Apropos of the above station is a report from Arthur Cushen, who says, "WLWS-2 is on 7.83 m.c. from 8.45-10.30 p.m.," and Rex Gillett writes that he hears WLWX on 7.825 m.c., opening at 8.45 p.m. in Spanish." Well, if we are all thinking of the same station, the call is WLWS, my authority being a programme from The Crosley Corporation, giving frequency as 7,832.5 kilocycles and a wave-length of 38.3 met. The schedule is: 8.45-10.15 p.m., the language Spanish and programme is directed to Latin-America. Incidentally, the same programme is on WLWS, 6.37 m.c., 47.10 met.—L.J.K.

•

"Victory Radio Club" prints a complete list of the new Canadian Broadcasting Corporation shortwave transmitters as of December, 1944:

CKOB,	Sackville	N.B.	6.09	m.c.
CHAC	„	„	6.16	„
CKLO	„	„	9.36	„
CHLS	„	„	9.61	„
CHMD	„	„	9.64	„
CKXA	„	„	11.705	„

CHOL	„	„	11.72	„
CKCX	„	„	15.19	„
CHTA	„	„	15.22	„
CKNC	„	„	17.82	„
CHLA	„	„	21.71	„

Of these only CHTA, on 15.22 m.c., is known to be operating. Schedule is: 8.45 to 11.15 p.m.

I am afraid we will have to wait for another frequency to open up, as it is unlikely we would hear 15.22 at the times quoted.—L.J.K.

•

OAX4Z, Lima, "Radio Nacional de Peru," relays OAX4A, long-wave, 854 k.c., has moved from 6.082 m.c. to 5.895 m.c. Has excellent signals on this new frequency from 9 a.m. till 2 p.m. or later.—Howes "Universalite."

•

"South Americans not very numerous nor very powerful at present.—Gaden.

•

Arthur Cushen says The United Network use KNBX, on 21.61 m.c., 13.88 met., from 1 a.m. till 8.30 a.m. I doubt if it would be heard here during those hours, and Arthur does not say he has heard it, but I'll bet Wally Young or Rex Gillett will find it if audible.—L.J.K.

•

Listeners were probably surprised to find GRU on its new frequency of 9.915 m.c. missing at 8 p.m. The new schedule is 10.15 p.m.-6.30 a.m.; 8-11 a.m.; 2-3.30 p.m. Very nice signal when taking the news in the BBC American service at 2.30 p.m. —L.J.K.

"Am sorry BBC closes at 3.30 p.m. on 9.915 m.c.; should be kept on longer as it is a much better signal than GSB."—Cushen. (That is my opinion, too, Arthur.—L.J.K.)

•

Mr. Rex Gillett reports hearing a Cuban on 33.30 met., but he does not give call-sign or frequency. According to my records this may be COKG, who is supposed to have moved from 8.955 m.c. to 9.00 m.c., although November "Radio Guia" still shows them as on 8.955 m.c. Then, according to "Radio Craft," there is a new one—COKW, on 8.985 m.c.—which is NOT yet shown in "Radio Guia," so it's up to any call-sign. Is this COKG? Well, Adelaide, Killarney or Invercargill to be first in with the correct call. Just to make it all the more difficult, veteran Wally Young rushes in a report that he is hearing a Cuban on 33.48 met., but does not suggest I can't help, as it is too noisy in that area for me at the time these boys are hearing Havana, so we will leave it to the triumvirate and trust we will have a story for the April issue.—L.J.K.

NEW STATIONS

GWS is the call-sign for the new BBC on 6.035 mc, 49.71 m. This station is the one referred to in January issue under "Says Who?" as heard by Mr. Rex Gillett, but call then unknown.—L.J.K.

OIX-4, Lahti, 15.19 mc, 19.75 m: This old-timer who, in a country for many years under German domination, deserves to be classed as a new station. Rex Gillett reports hearing them from opening at 10.15 till closing at 10.30 p.m. Signal is not good but announcement in English was heard, "This is Finland calling." English continued for about five minutes, then Finnish.

Just after receiving Rex's mention of Finland, I rang Mr. Edel and he telephoned me at 8.30 p.m. that they were then on the air in Finnish. They were audible, but the strong signal of GSO, N15.18 mc, spoilt reception. By 8.50 they had either gone or faded out. I have shown location as Lahti and call OIX-4, which was the case before the war.

KCBF, 'Frisco, 7.57 mc, 39.6 m: This is a new channel for the C.B.S. and is used from 4.15 to 6.15 p.m. in Armed Forces Service. Signal is only fair, being in a noisy area. Is in parallel with KCBA, 6.17 mc, 48.62 m.

KNBX, 'Frisco, 7.57 mc, 39.6 m: Hugh Perkins drew my attention to this one and I was mighty glad to have the information. I could not hear KNBX on 9.49 mc, at 7 o'clock, not even a carrier, although his playmate, KNBI, on 6.02 mc, was going as large as life. Schedule is 7 p.m. till 12.45 a.m. Signal seldom gets about R5, morse being prevalent.

KNBA, 'Frisco, 7.805 mc, 38.43 m: The N.B.C. have introduced this frequency and it is heard well from 7-11 p.m. Is at that time in parallel with KNBC, 9.70 mc, 30.93 m.

——, Moscow, 6.23 mc, 47.68 m: As prolific as their victories on the battlefields is the introduction of new outlets for the U.S.S.R. programmes. Here is a new one discovered by Mr. Edel. He says at 4 a.m. signal is good and news in English is given.

PARIS changes: Mr. Edel tells me Paris has dropped 19.87 m and, from 10-11.30 p.m., with programme directed to Indo-China, is on 19.53 and two old Paris spots, 19.68 and 19.83 m. Opens as usual with "Marseillaise."

I find it is sometimes three minutes past 10 before they open and, whilst 19.53 and 19.83 may be there when "Marseillaise" played, often drop out.

KROJ, 'Frisco 15.19mc, 19.75m
Opens 6 a.m., closing as usual at 7.45 a.m.

GSC, London 9.58mc, 31.32m
From 4th March will be added to Pacific Service directed to New Zealand and Pacific Area from 3.45-8 p.m.

GSN, London 11.82mc, 25.38m
Withdrawn from Pacific Service as from 4th March.

KNBC
Has moved back to 15.15mc, 19.81m from 11.45 a.m. to 1.15 p.m.

Changes effective 2nd March

The MONTH'S LOGGINGS

ALL TIMES ARE EASTERN AUSTRALIAN STANDARD TIME

Pressure on space only permits of unusual Loggings or alterations in schedules or frequencies.

Readers will show a grateful consideration for others if they will notify me of any alterations. Please send reports to L. J. Keast, 23 Honiton Avenue W., Carlingford. Urgent reports, 'phone Epping 2511.

AFRICA

AFHQ, Algiers 11.885mc, 25.24m
Good strength at 12.45 a.m. with CBS programme (Gillett).

AFHQ, Algiers 11.765mc, 25.50m
Relays CBS programme at 12.45 a.m. (Gillett).

AFHQ, Algiers 9.61mc, 31.22m
Heard in programme in English from about 8-9.45 a.m. (Gillett).

AFHQ, Algiers 9.535mc, 31.46m
Also heard from 8-9.45 a.m. in English (Gillett).
——, Algiers 6.04mc, 49.67m
Back again with news in English at 6.30 a.m. (Gillett).

Bechuanaland

ZNB, —— 5.90mc, 50.90m
Radio Newsreel at 5.30 a.m. Fair (Gillett).

Belgion Congo

RNB, Leopoldville 9.785mc, 30.66m
Very fine before breakfast, quite good at 2.30 p.m. with an improving signal (Gaden). Heard at 2.15 a.m. (Edel).

RNB, Leopoldville 9.385mc, 31.95m
Good signal at 2.45 a.m. (Edel).

Egypt

JCJC, Cairo 7.22mc, 41.55m
"The Forces Programme" from about midnight to 7 a.m.; fairly good signal (Gillett).

French Equatorial Africa

FZI, Brazzaville 11.97mc, 25.06m
Good signal closing at 4 p.m. (Clack). Still O.K. (Gaden).
FZI, Brazzaville 9.44mc, 31.78m
Weak on closing at 7 a.m. (Clack).

Madagascar

Radio Tananarive, Tananarive
12.127mc, 24.73m
Heard closing transmission to Inda-China with "Marseillaise" at 11.30 p.m. (Edel, Gillett).

Mozambique

CR7BE, Lourenco Marques
9.703mc, 30.91m
Heard closing strongly at 6.40 a.m. (Gillett, Gaden).
(Note change in frequency.—L.J.K.)

CR7AA, Lourenco Marques
5.865m, 51.15m
Fairly good at 5.45 a.m. with music (Gillett).

THE EAST

China

XGOY, Chungking 11.909mc, 25.17m
R7 signal from 8 p.m. (Clack).
XGOY, Chungking 6.14mc, 48.86m
Good at 9.45 p.m. in relay with 41.96m (Gillett).

XGOY, Chungking 5.90mc, 50.85m
News in English at midnight in relay with 6.135mc, 48.92m. Both close at 12.15 a.m. (Edel).

India (Delhi unless otherwise mentioned)

VUD-8 .... 15.35mc, 19.54m
Good signal at 11.45 a.m., 1.30, 7.30 and 9.30 p.m. (Clack).
VUD-8 .... 11.87mc, 25.27m
Fair only at 1.30 p.m., but R7 with news at 7.30 p.m. Stronger later in the night, but suffers from QRM (Clack).
VUD-6 .... 11.79mc, 25.45m
Fair only with Luxembourg effect on the signal at 1.30 p.m. At 5 p.m. strength is R7 (Clack).
VUD-5 .... 11.76mc, 25.51m
Good signal for 11.45 a.m. until after noon (Clack).
VUD-4 .... 9.59mc, 31.28m
The 9.30 p.m. session is by far the strongest Indian I have heard and the news commentaries are, in my opinion, outstanding examples of what commentaries should be (Clack).
VUD-5 .... 7.275mc, 41.24m
R5 when broadcasting news from 9.30-10 p.m. (Clack).
VUD-6 .... 7.215mc, 41.61m
Announces as "—— Forces Programme from New Dehli." Closes 11 p.m. (Gillett).
VUD- 6.10mc, 49.15m
Very strong in Dictation Speed News at 5.30 a.m., closes at 6 a.m. (Gillett).
VUD- 6.06mc, 49.50m
Opens strongly at 11.15 p.m. (Gillett).

Ceylon

S.E.A.C., Colombo 15.275mc, 19.64m
Weak but audible at 1.30 p.m. (Clack).

Philippines

WVLC, Leyte 7.795mc, 38.48m
Heard relaying messages from Manila at 12.30 a.m. (Edel).
Who is going to be the first to report KZRM or KZRH?

CENTRAL AMERICA

Costa Rica

TIPG, San Jose 9.62mc, 31.19m
Opens at good level at 10.05 p.m. (Gillett). Is quite good when in the clear at night; weak at 1 p.m.—should be better shortly (Gaden).

Guatemala

TGWA, Guatemala City.... 15.17mc, 19.78m
Heard very well before 7 a.m., one of the best on the band at times (Gaden). Heard at 9.45 a.m. (Young).

GREAT BRITAIN

BBC, London

GSF 15.14mc, 19.82m
As good as any of the BBC's at night (Gaden).

GVX 11.93mc, 25.15m
Received well here, used to open at 3.45 p.m., now comes in at 2 o'clock (Cushen).

GRU 9.915mc, 30.26m
Heard from 8-10.45 p.m., also at 3 a.m. and closing at 6.30 a.m. (Gillett). (New schedule is: 10.15 p.m.-6.30 a.m.; 8-11 a.m.; 2-3.30 p.m.—L.J.K.)

GRH 9.825mc, 30.53m
Is OK at 2.30 p.m. with news (Gaden).

GRX 9.69mc, 30.96m
Old KRX in Pacific Service is doing a good job (Gaden).

GWI 7.25mc, 41.38m
Excellent signal at 6.30 a.m., but in the afternoon not so welcome. At 5.45 p.m. for 15 minutes, as Radio Luxembourg often upsets reception from KGEX. At 6 o'clock in German, at 6.10 in Czech and from 6.20 to 6.30 in Polish also spoils KGEX.—L.J.K.

GRN 6.195mc, 48.43m
The A.E.F. station of the BBC puts up a very good performance at 6 p.m. (Gaden).

A.B.S.I.E.

—— 6.11mc, 49.10m
News at 6.30 a.m.—fair (Gillett).
—— 6.05mc, 49.59m
Opens at 6.45 a.m. in relay with 49.10m (Gillett).
—— 6.01mc, 49.92m
Heard in German at 4 a.m. with R8 Q5 signal (Edel).

SOUTH AMERICA

Brazil

PRL-8, Rio de Janiero 11.72mc, 25.60m
Closes at 6.30 a.m. with chime.—L.J.K.
PRL-7, Rio de Janiero 9.72mc, 30.86m
Sometimes reasonably good from 8-9 a.m. (Gaden).

Dutch Guiana

PZX-5, Paramaribo 15.395mc, 19.48
Signal is R7 but noise some nights terrific (Clack). Good level from 9 p.m.; closes various times, latest heard 9.50 p.m. (Gillett).

Ecuador

HCJB, Quito 15.09mc, 19.87m
Heard at fair strength at 9.55 p.m. (Gillett). Heard religious service till 6.30 a.m., then, after numerous announcements in English, they go into French. Have heard the announcement that they were broadcasting in the 31, yes, the 31, 24 and now on the 19-metre
HCJB, Quito 9.958mc, 30.12m
Fair at night (Gaden).
HC2ET, Guayaquil 9.19mc, 32.64m
An old favourite of mine heard around 8 a.m. and again at 3 p.m.—not very strong (Gaden). Heard at 9.45 a.m. (Young).

Paraguay

ZPA-5, Encarnacion 11.95mc, 25.10m
Heard closing at 2 p.m. with fair signal (Cushen).

U.S.A.

San Francisco unless otherwise mentioned

KRHO, Honolulu 17.80mc, 16.85m
Opens splendidly at 9 a.m., or as they call it, 8 a.m. Tokyo time. Splendid right through, but weakens towards closing at 4.40 p.m. Long closing announcement (Gaden). News is give at dictation speed at 1.30 p.m.—L.J.K.)
KROJ 17.76mc, 16.89m
Heard KROJ at fair strength opening at 11 a.m. (Perkins). Like this better than when he is on 19.75m earlier, but he cannot hold a candle to KRHO (Gaden).
KWID 17.76mc, 16.89m
Very nice signal before breakfast, news at 7 and 8 (Gaden).
NPM, Pearl Harbour 15.92mc, 18.84m
Heard at 9.45 a.m. (Young).
KNBI 15.34mc, 19.56m
Heard with R6 signal at 10.15 a.m. (Perkins).
KCBA 15.275mc, 19.64m
Opens at 7 a.m. (Gillett). Very nice at closing (10.30), but KGEX is best on this band, with KRCA next (Gaden).
KNBC 15.24mc, 19.69m
Heard nicely at 1 p.m. (Perkins). Not bad signal but like 13.05mc better (Gaden). (Both close at 1.15 p.m.—L.J.K.)
KGEX .... 15.21m, 19.72....
R5-6 from 11 a.m. till closing at 1.15 p.m. (Clack).
KNBX 11.89mc, 25.23m
Heard with R4 signal at 10.15 a.m. in United Network programme (Perkins).

KNBC 11.89mc, 25.23
From 3 p.m. is R6-8 for an hour or so, then terrific interference sets in (Clack). In parallel with KNBA closing at 6.45 p.m. (Perkins, Gillett).

KCBF 9.75mc, 30.77m
Heard at 8.25 p.m., but signal only R3-4, improving to R4-5 at 9 o'clock. Morse very bad (Perkins). Usually good (Gaden). (Signal down here is O.K. from 7 till nearly 10 o'clock, but by that time WLWR-1, who opened in European Service at 9, begins to make himself felt.—L.J.K.)

KNBC 9.70mc, 30.93m
Heard in relay with KNBA at 10 p.m. (Perkins). Opens at 7 p.m. (Gillett).

KGEI 9.55mc, 31.41m
Fair signal with news at 4 p.m. (Clack). (Opens at unusual hour of 3.20 p.m.—L.J.K.)

KNBA 949mc, 31.61m
Is R8 Q5 from 5 p.m. till closing at 6.45 (Clack). Heard "Seabees Hour" (Perkins). Suffers interference from GWF for last 30 minutes or so.—L.J.K.)

KNBX 9.49mc, 31.61m
Opens at 7 p.m. (Gillett). (Was in parallel with KNBI, 49.83, for several weeks, but has moved to 7.57mc, 39.6m.—L.J.K.)

S-2 .... 8.93mc, 33.58m
Very good at night (Perkins). (Yes, a surprisingly good signal last week or so.—L.J.K.)

KRCA 7.805mc, 38.43m
Has been heard very badly at closing (Gaden). (Schedule: 1-3 p.m.—L.J.K.)

KNBA 7.805mc, 38.43m
Heard in Oriental language until closing at 11 p.m. in parallel with 9.70mc (Cushen, Perkins, Gillett). Better signal than KNBI and like it better than KNBC on 9.70mc (Gaden).

KCBF 7.57mc, 39.6m
Heard at 6.02 p.m. giving 5-minute news-cast, R4-5, with a bit of morse on top; closes 6.15 p.m. (Perkins, Gaden, Cushen).

KNBX 7.57mc, 39.6m
See "New Stations."

KGEX 7.25mc, 41.38m
Heard well at night (Perkins). Strong signal from opening at 5 p.m., but suffers from bad interference later in the evening (Cushen). See "Says Who?"

KRCA 6.18mc, 48.54m
Opens at good strength at 7 p.m. (Gillett, Perkins).

KCBA 6.17mc, 48.62m
Heard in United Network programmes closing at 4 p.m.—L.J.K. Opens at 7 p.m. (Gillett).

BA 6.17mc, 48.62m
Heard closing at 6.15 p.m. and reopening at 7; signal splendid at night (Perkins, Cushen). Not as good as most of the others (Gaden).

HO, Honolulu 6.12mc, 49.02m
Very good all night (Gaden, Gillett, Perkins). (Like its sister on 17.8mc, spends a lot of time on the air, viz., 5 p.m.-1.15 a.m.; 1.30-5 a.m.—L.J.K.)

KROJ 6.10mc, 49.15m
R6-7 signal from 7 p.m. nightly, but noise level very high (Clack).

KGEI 6.09mc, 49.25m
Like this on the new frequency (Perkins). R7 from 6.30 p.m. (Clack). Probably best of night San Franciscans (Gaden).

KNBI 6.02mc, 49.83m
Opens at 7 and about about the weakest 'Frisco transmitter (Gaden).

Other than 'Frisco and Honolulu

WLWO, Cincinnati 17.80mc, 16.85m
Very fine at breakfast time (Gaden). (Programme, and a good one, too, is for Latin-America from 7.30-8.45 a.m.—L.J.K.)

WLWL, Cincinnati 13.022.5mc, 23.03m
Excellent signal (R8) every morning between 6.30 and 8.30 (Clack). (Schedule is 5.30-9 a.m. directed to North Africa.—L.J.K.)

WLWL, Cincinnati 12.96mc, 23.13m
Like this fellow very much, closes 9 a.m. (Gaden).

WNBI, New York 11.87mc, 25.27m
Carries Latin-America transmission. Is heard closing at 2 p.m. with long English announcements—interference from Delhi (Cushen).

WRUL, Boston 11.73mc, 25.58m
Fair signal from 7-8 a.m., but suffers from QRM. Not audible on re-opening at 8.15 (Clack).

WLWX, Cincinnati 11.71mc, 25.62m
Spanish language at 8.30 a.m. (Gillett).

WBOS, Boston 9.897mc, 30.31m
Good signal every morning until closing at 7.45 (Clack). Interference spoils a good signal and a good programme, especially the final five minutes before closing at 7.45 a.m. (Gaden).

WLWL, Cincinnati 9.897mc, 30.31m
Heard call at 10 a.m.—the best 30-metre at that time (Gaden).

WNRA, New York 9.85mc, 30.44m
News headlines at 7 a.m., followed in two or three minutes by Cross Section—excerpts from Editorials—very good and good signal.—L.J.K. Good up until after 10 a.m. (Gaden).

WNRI, New York 9.85mc, 30.44m
Excellent in musical programme at 10.30 p.m.—L.J.K.

WLWR, Cincinnati 9.75mc, 30.77m
Great signal at 7.30 a.m. (Cushen). Very nice at 8 and 9 a.m., but weakens a lot after 10 o'clock (Gaden).

WLWR-1, Cincinnati 9.75mc, 30.77m
Opens at 9 p.m. and very quickly puts up a fight with KCBF. Before closing at 1 p.m. the next day, uses English, French, Belgian, Italian, Dutch, takes a relay from the BBC, has a variety programme and, to cap off, a musical programme of long duration.—L.J.K.

WCBN, New York 7.832.5mc, 38.30m
Has Armed Forces Radio Service programme at 6.30 a.m. Still heard at 8 but fades fast (Cushen). Heard from 7.30-9.15 a.m. (Gillett).

WOOW, New York 7.82mc, 38.36m
Heard well at 7.30 a.m. (Gaden).

WNRI, New York 7.57mc, 39.6m
Not too good—weakens before 10 a.m. (Gaden).

WLWS-1, Cincinnati 6.37mc, 47.10m
In parallel with WLWS-2, 832.5mc, from 8.45-10.15 p.m.—L.J.K.

WOOC, New York 6.12mc, 49.02m
Heard nicely at 7.30 (Gaden).

WNRX, New York 6.10mc, 49.15m
Is good enough for the 8 a.m. session, but weakens and fades out earlier than the other two NBC's in parallel (Gaden).

WRUW, Boston 6.04mc, 49.67m
Spanish language programme 6.30 a.m. (Gillett).

U.S.S.R.

Moscow unless otherwise mentioned

—— 15.23mc, 19.70m
Now heard well in 8.40 a.m. session in English. At 9.15 said they were on 6.98, 7.3, 11.88, 11.95 and 15.23mc.—L.J.K.

—— 12.26mc, 24.47m
Calling BBC for a talk in Italian at 10.30 p.m. (Edel).

—— 9.725mc, 30.85m
Heard at 12.15 a.m. (Young). (This is also the frequency for Leningrad.—L.J.K.)

—— 9.09mc, 33.00m
Heard at 1.45 a.m. (Young).

——, Azerbaijan Prov. 6.50mc, 46.15m
Music and talks. Closes 1.15 a.m. On again at 2.30 a.m. (Edel).

—— 6.30mc, 47.68m
News in English at 4 a.m. (Edel).

—— 6.24mc, 48.07m
News in English at 3 a.m. (Edel).

—— 6.07mc, 49.42m
News in English at 9.40 and 10.20 p.m. (Edel).

WEST INDIES

Cuba

COBC, Havana 9.37mc, 32.00m
At 7 a.m. is fairly good with music (Gillett).

COCX, Havana 9.20mc, 32.36m
Good at 7.30 a.m. (Gillett).

COBQ, Havana 9.22mc, 32.54m
Fair strength in between morse at 7 a.m. (Gillett).

——, Havana .... ——mc, 33.30m
See "Says Who?"

Haiti

HH3W, Port-au-Prince 10.13mc, 29.62m
Opens with trumpets at 9.30 p.m. (Edel). Good nightly from 10 p.m. (Gillett).

MISCELLANEOUS

Arabia

ZNR, Aden 12.11mc, 24.77m
Announcements in English at 2 a.m., but programme continues in Arabic (Edel).

ZNR, Aden 6.75mc, 44.38m
Same remarks as above (Edel). Heard well at 2 a.m. (Young).

Canada

CBFX, Montreal 9.63mc, 31.15m
Good musical programme at 11.15 p.m. (Gillett). (All India Radio kindly moving to 31.28m has made it possible to hear with pleasure our Canadian cousins.—L.J.K.)

Finland

OIX-4, Lahti 15.19mc, 19.75m
See "New Stations."

France

——, Paris 15.095mc, 19.87m
Very good opening at 10 p.m. (Gillett). See "New Stations."

——, Paris 9.50mc, 31.58m
Heard closing at 7 a.m. with "Marseillaise" (Gillett).

Italy

HVJ, Vatican City 5.968mc, 50.26m
At 4.45 a.m. were giving messages in Polish (Edel).

Iraq

Radio Baghdad 7.09mc, 42.32m
Heard at 11.15 p.m. (Young).

Mexico

XEWW, Mexico City 9.50mc, 31.58m
Weak but audible around 3 p.m. (Clack). Best signal for these parts in afternoon (Gaden).

XEQQ, Mexico City 9.68mc, 30.99m
Heard weakly at 8 a.m. and with fair signal in afternoon (Gaden).

Portugal

CSW-6, Lisbon 11.04mc, 27.17m
Just audible at 8.50 a.m.—L.J.K.

Emissora Nacional, Lisbon
6.375mc, 47.06m
At 5.32 a.m. said, "Lisbon Emissora National." Speech in Portuguese R6 Q4 (Edel).

Sweden

SBT, Stockholm 15.15mc, 19.80m
Calling WLW, Cincinnati, at 10 p.m. (Gillett). At 1 a.m. Monday, heard in English a talk on Swedish Industry. At 1.18 said, "That is the end of our weekly review in English. Programme continued in Swedish (Edel).

SBP, Stockholm 11,705mc, 25.63m
In parallel with SBT at 1 a.m. (Edel).

SBO, Stockholm 6.065mc, 49.46m
Classical music with customary 11 bells at 6.30 a.m. (Gillett).

Switzerland

HER-5, Berne 11.96mc, 25.08m
Heard at 4.45 p.m. (Young).

HER-, Berne 12.965mc, 23.14m
Heard at 6.30 p.m. Tuesday and Saturday (Young).

HEI-5, Berne 11.715mc, 25.61m
I never get tired of the lovely opening signal on Tuesdays and Saturdays just before 6 p.m.—L.J.K.

HEI-2, Berne 6.345mc, 47.28m
At 4.45 a.m. in French gives location as Lausanne, but may be broadcast relay (Edel). Heard at 5.45 a.m. (Young).

——, Geneva 18.45mc, 16.26m
Heard at 1.30 a.m. (Young). (Is this Berne? I understood all s.w. transmitters are now at Berne.—L.J.K.)

Syria

Radio Levant, Beirut 8.035mc, 37.34m
Heard at 11 p.m. (Young). Heard sermon in English at 12.50 a.m. Monday at 1.03 a.m. "Ici Radio Levant" (Edel). band on 15.09mc (Gaden).

HCJB, Quito 12.445mc, 24.08m
Fairly good at night (Gaden).

Speedy Query Service

Conducted under the personal supervision of A. G. Hull

C.W. (Cairns, Q.) complains that we do not publish enough circuits and articles or how to build sets.

A.—Unfortunately the construction of receivers, and the use of component parts for any purpose other than the maintenance of existing receivers is controlled under National Security Regulations. To devote space to inciting readers to break the regulations might be considered a waste by our more seriousminded supporters.

* * *

P.P.G. (Camberwell, Vic.) has a broken-down set which has a bright light in one of the valves.

A.—It all depends on which valve is showing the light. If it is the rectifier, which will most likely be indicated by having number 80, on the glass or base, the indication is that there is a short-circuit of the high tension current, probably due to a broken down condenser. On the other hand if the trouble is in the output valve (type 42, 6F6, 6V6, etc.) the indication is a breakdown in the speaker transformer. Of course, there are a thousand other possibilities and it is pretty hopeless to tell you all you need to know about finding and curing every possible breakdown trouble in a set, especially when you don't even mention the type of set, brand or model.

* * *

"Y.Y.Y." (Bendigo) finds that an earth wire makes little difference to his a.c. operated set at home, but when using a battery set out on his farm the earth wire makes a lot of improvement to reception.

A.—Yes, this is quite normal. The a.c. set is earthed by virtue of capacity effects between the power mains and earth. Even if the earth wire did make a difference to the a.c. set it would be disguised by the automatic volume control action, except on the weakest stations.

* * *

"Susie" (Clovelly) is interested in high-quality reproduction.

A.—Welcome to the ranks of gramophone enthusiasts. You are not by any means the only subscriber from the fair sex. Some of my toughest technical queries are asked by young ladies who are working on equipment of advanced design, such as volume expanders and compressors. Girls are doing plenty of work in the radio factories, too, and old-timers will recall that one of Sydney's earliest radio parts shops was McKenzie's.

* * *

K.C. (Ballarat) has one of the Airzone audio transformers of the small high-fidelity type but is doubtful about its correct application.

A.—With this transformer and others using similar types of modern small cores it is essential to keep direct current out of the windings as otherwise it will affect the core characteristics in such a way that nothing can be done, except possibly to return the core to America for fresh heat treatment. The proper way is to feed the plate of the valve through a resistor of about 50,000 ohms, and couple the output into the primary of the audio transformer through a .1 or .5 mfd. condenser, earthing the other end of the primary or connecting it back to high tension. Loading resistors of .1 megohms should be fitted across the two sections of the secondary, or a.2 megohm from grid to grid.

* * *

T.P. (Kew) enquires about the Wireless Institute.

A.—Yes, the Wireless Institute of Australia is still active. Meetings are held on the first Tuesday in each month at the rooms, 191 Queen Street, Melbourne. We suggest you go along to one of these meetings and doubtless the Secretary will take you in hand. Membership secretaries, T. D. Hogan, 'phone UM173p and J. G. Marsland, 'phone WM 3958.

* * *

H.S. (Wagga Wagga) asks about Sir Ernest Fisk.

A.—It is said that Sir Ernest is to take up the position of Managing Director of E.M.I. in England. E.M.I. stands for Electric and Musical Industries, and is a vast organisation. We understand that it is closely associated with H.M.V. (The Gramophone Company) and possibly with many other radio companies, but it is not to be confused with the English Marconi Company.

FILING RESISTORS

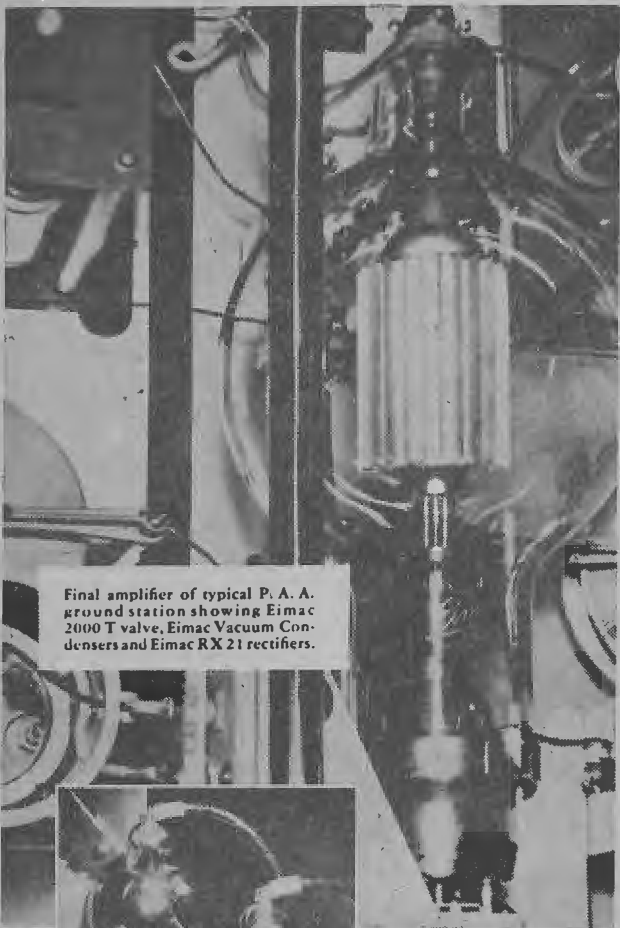
(Concluded from last month's issue)

ment is bad practice anyway, and that they would rather pay the price for new components than risk using old ones containing possible unseen faults. This argument is quite a good one, but to reassure those enthusiasts who find it necessary to do things cheaply, I have recently built six or seven pieces of high quality test equipment, all using second hand parts and in no case have any of these been troublesome owing to the age and previous use of their components. The one stringent necessity is, however, to carefully test in every way possible all second hand units before re-using them.

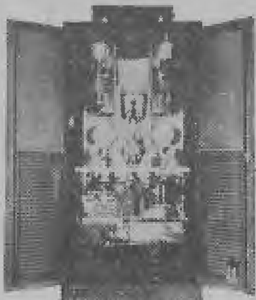
RADIO IN SUPERFORTS

The nose section of the B-29 Superfortress, America's newest air weapon, contains all facilities for the bombardier, pilot, co-pilot, flight engineer, navigator and radio operator. Included in the items of equipment are 14 different radio systems. The nose section also takes four of the eight miles of electrical wiring in each ship.

PAN AMERICAN USES EIMAC VALVES



Final amplifier of typical P. A. A. ground station showing Eimac 2000 T valve, Eimac Vacuum Condensers and Eimac RX 21 rectifiers.



Pan American World Airways, which has done so much to advance the war-time goals of the nation, has just announced a plan for a new service to South America. Employing a fleet of stratosphere planes, carrying 108 passengers, flying at more than three hundred miles an hour, Pan American proposes to take travelers from New York to Rio de Janiero in less than twenty hours instead of the present sixty-six hours, charging $175 for the trip, as against the current rate of $491.

Pan American Airways and all its associated and affiliated companies, which comprise the P. A. A. World System, have been using Eimac valves in the key sockets of all ground stations for a number of years.

Because of the extensive operations of Pan American World Airways, these valves have been subjected to about every test possible — altitudes; ground level; extremely cold climates and high temperatures found at the equator; conditions of high and low humidity; and in some instances, when new bases are being built, perhaps somewhat trying power conditions. The high regard which P. A. A. engineers have for Eimac valves is clearly evidenced by their continued and more extensive use, as the years roll by.

The fact that Eimac valves are the number one favorite of the commercial airlines is important evidence to substantiate the oft repeated statement that "Eimac valves are first choice of leading electronic engineers throughout the world."

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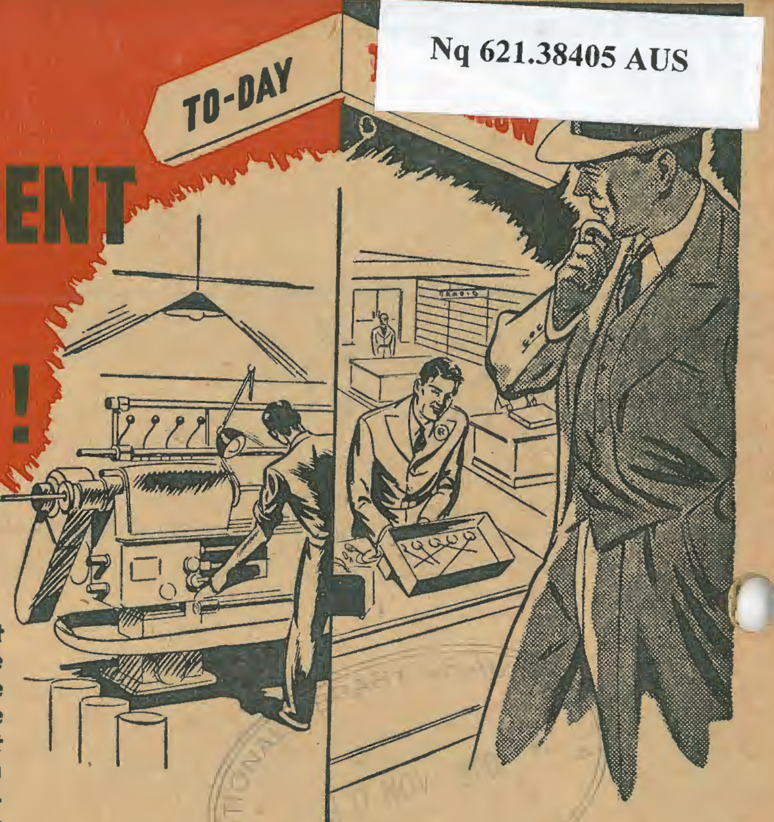

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—D.H., Home Hill, Q'ld.

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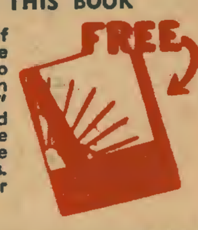

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