

Appointment of Scientific Advisory Committee

The B.B.C. has appointed a Scientific Advisory Committee whose terms of reference will be: "To advise on the British Broadcasting Corporation's scientific research and its correlation with external activities in the same field."

The following have accepted invitations to serve on the committee:—Chairman: Sir Edward Appleton, G.B.E., K.C.B., F.R.S., Secretary, Department of Scientific and Industrial Research. Vice-chairman: Sir John Cockcroft, C.B.E., F.R.S., Director, Atomic Energy Research Establishment. Other members: Dr. H. G. Booker, Christ's College, Cambridge; Professor Willis Jackson, Imperial College of Science and Technology; Dr. R. L. Smith-Rose, Department of Scientific and Industrial Research, and Professor F. C. Williams, O.B.E., Electro-Technical Laboratory, Manchester University.

The Electron in Theory and Practice

Sir Edward Appleton, Secretary of the Department of Scientific and Industrial Research, delivered the Second Dunn Memorial Lecture to the Society of the Chemical Industry in Newcastle on June 1, 1948, on "The Electron in Theory and Practice."

"In conjunction with the Ministry of Supply and a number of Research Associations we in D.S.I.R." Sir Edward Appleton said, "have recently been paying a good deal of attention to possible industrial applications of electronics. We have formed an Advisory Panel under the chairmanship of Sir Charles Darwin, Director of the National Physical Laboratory, which aims at bringing together the research worker, the supplier and the user, and, in addition, groups have been formed at T.R.E. and the National Physical Laboratory to examine industrial problems at first hand with a view to suggesting how electronic equipment could be employed in their solution. These activities, in the long run, should help to step up the volume of production, improve quality and release men and women now engaged in routine operations for tasks usually more congenial and calling for a greater exercise of human intelligence."

The Use of Radar at Sea

A recent meeting of the International Conference on Safety of Life at Sea approved a new agreement to replace the International Convention of 1929.

It was recommended that Governments should regularly exchange information on radio and radar aids to navigation and should encourage the use of radar installations on ships.

The report on radio telegraphy and telephony approved the fitting of radio telegraph installations on all passenger ships, irrespective of size, and all cargo ships over 1,600 tons, unless specially exempted.

Demagnetising Valves

As a Cure for Residual Ripple

SIR,—During the last few years we have been developing methods of heating with raw A.C. the input stages of high-gain balanced low-frequency amplifiers for biological purposes. In previous communications (*ELECTRONIC ENGINEERING* 19, 221: 1947, 19, 81, 1947) it was pointed out that the "electrostatic" component of the ripple from A.C. heaters can be reduced by (a) using a screened heater winding; (b) lowering the voltage of the supply to, say, 3.5 to 4V for 6-volt valves; (c) biasing the heater circuit through a "humdinger." The "magnetic" component can similarly be reduced by lowering the heater current to below a critical value.

When, in spite of these precautions, residual ripple is troublesome, this is usually due to the magnetic component, which cannot of course be balanced out with the humdingers, and is worse when the input grid impedance is low. There is great variation between individual valves in this respect and careful selection has been necessary: when using a type of valve which is satisfactory in other ways (e.g., EF. 37), up to 50 per cent. have been found intolerable because of magnetic heater ripple. Until recently we have had no explanation of the great variation between individual valves, though we noticed that there was also considerable variation between batches obtained from different sources and with different histories.

In the course of setting up some hundreds of these amplifiers the problem of selecting input valves became so acute that we were forced to look for the source of the trouble. Now some years ago, we noticed that this residual ripple could often be eliminated by placing a small permanent magnet a few inches from the input valves in an empirically determined position and orientation. This solution, though satisfactory for a single channel, did not commend itself for multi-channel instruments; moreover, we were unable to decide why the effect should be produced.

Continuing on these lines, however, we found that if the magnet was brought very close to the valve and then removed, the ripple in-

variably became worse and remained so, the conclusion being that magnetisation of the valve electrodes had a deleterious effect. We accordingly tried de-magnetising unsatisfactory valves in a decreasing AC field, and found that even the worst offenders could be "cured" in this way, whether they had previously been deliberately magnetised or not.

As a further check we have investigated the magnetic properties of "good" and "bad" specimens and find that "good" valves induce no current whatever when moved in and out of a coil, whereas "bad" ones generate considerable currents, in proportion to the amount of magnetic ripple which they produce as input amplifiers.

As a result of the de-magnetisation procedure the proportion of ripple rejects has been reduced to zero, so that selection need now be made only on the basis of microphony and "noise." It is to be expected that during manufacture and storage of valves, they would have ample opportunity to become magnetised either in the earth's field or from ferrous materials.

We should be very grateful to have a rigorous explanation of this effect and references to it in the literature, of which we have so far discovered none.—Yours faithfully,

W. GREY WALTER, D.Sc.

H. W. SHIPTON, Assoc. Brit. I.R.E.

W. J. WARREN.

Burden Neurological Institute.

THE HOME - BUILT TELEVISOR

2nd Edition. Revised and Reprinted.

Now Ready.

Copies may be obtained from:—
THE CIRCULATION DEPARTMENT
ELECTRONIC ENGINEERING
28, Essex Street, London, W.C.2.
PRICE 2 8d. including postage.

CORRESPONDENCE

Demagnetising Valves

DEAR SIR,—The reduction in residual anode-current ripple brought about by demagnetising a valve electrode structure, remarked upon by Dr. Grey Walter and Messrs. Shipton and Warren in their letter in your July issue, may perhaps be explained by comparison with the operation of the normal magnetic telephone earpiece as described in Terman's *Radio Engineering*, if it is assumed that modulation of the valve anode current is due to relative physical movement of portions of the valve electrode structure under the influence of the alternating magnetic field produced by the valve heater current.

Terman states that the force acting on the telephone receiver diaphragm is proportional to the square of the flux density in the air-gap between the diaphragm and the pole-pieces of the magnet assembly. Then if B_0 is the flux density due to the permanent magnet, and $B_s \sin \omega t$ is that due to the alternating signal current in the magnet windings.

Total pull on diaphragm:

$$(B_0 + B_s \sin \omega t)^2$$

$$= B_0^2 + 2B_0 B_s \sin \omega t + \frac{B_s^2}{2} (1 - \cos 2\omega t)$$

The first term represents the constant pull produced by the permanent magnet; the second denotes a force alternating at the same frequency as the alternating component of the flux and proportional in amplitude to the strength of the permanent magnet; the third term contains second harmonic distortion and will be relatively small if $B_0 B_s$, but will be the only term present if B_0 is reduced to zero.

The above explanation could perhaps be adapted to fit the observed result by substituting two portions of the valve electrode structure, relative movement of which could modulate the anode current, for the diaphragm and pole-pieces of the earpiece, and the valve heater current for the signal current in the magnet windings.—Yours truly,

J. V. CORNEY

Forest Gate.

SIR,—The suggestion which Mr. Corney makes as to the cause of the effect which we noted is interesting but calls for further comment. At first sight it would seem unlikely that there would be much flux produced by non-inductive heaters, and it was with modern H.F. pentode valves that the effect was noticed.

Since the effect is diminished by a relatively weak external A.C. field, it is surprising that the heater field does not itself diminish the effect. So far as we can see, the effect persists over long periods of use.

We should be interested to know if Mr. Corney has performed any quantitative experiments to establish the magnitude of the electron stream modulation if it is assumed that various valve components are magnetised.

H. W. SHIPTON,
W. GREY WALTER
W. J. WARREN

Burden Neurological Institute.

OCTOBER MEETINGS

Institution of Electrical Engineers

All meetings unless otherwise specified are held at the Institution of Electrical Engineers, Savoy Place, London, W.C.2.

Radio Section

Date: October 18. Time: 5.30 p.m.

Inaugural Address as Chairman.

By: F. Smith, O.B.E.

Date: October 19. Time: 5.30 p.m.

Discussion on "What should be the design considerations of Services' Radio Equipment?"

Opened by: S. J. Moss and G. C. F. Whittaker.

Measurements Section

Date: October 26. Time: 5.30 p.m.

Discussion on "Measurement of Phase Angle of Electric Circuits."

Opened by: Arvon Glynn, M.A.

The Secretary, Institution of Electrical Engineers, Savoy Place, W.C.2.

North-Western Radio Group

Date: October 20. Time: 6.30 p.m.

Held at: Engineers' Club, Albert Square, Manchester.

Lecture: "The Velodyne."

By: Professor F. C. Williams, O.B.E., D.Sc., D.Phil., and A. M. Uttley, Ph.D.

Hon. Secretary: A. L. Green, 244 Brantingham Road, Chorlton-cum-Hardy, Manchester 21.

The Television Society

Joint Meeting with B.K.S.

Date: October 27. Time: 7.15 p.m.

Held at: The Gaumont British Theatre, Wardour Street, London, W.1.

Lecture: "Studio and Outside Broadcasting Television Practice."

By: T. H. Bridgewater, A.M.I.E.E.

Lecture Secretary: T. M. C. Lance, 35 Albemarle Road, Beckenham, Kent.

Constructors Group

Date: October 18. Time: 7 p.m.

Held at: Cinematograph Exhibitors Association, 146 Shaftesbury Avenue, London, W.C.2.

Lecture: "The H.M.V. Television Receiver."

By: G. H. Watson.

Group Secretary: A. E. Sarson, 22 Union Road, Bromley, Kent.

Midlands Centre

Date: October 5. Time: 7 p.m.

Held at: Room 6, The Chamber of Commerce, New Street, Birmingham.

Lecture: "Description and Demonstration of some applications of valves and cathode ray tubes in Television."

By: C. A. Norman, B.Sc., and A. F. Hayes, B.Sc.

Hon. Secretary: R. T. Baxendale, 50 Alcester Road, Moseley, Birmingham.

Institute of Physics

Electronics Group

Date: October 5. Time: 5.30 p.m.

Held at: 47 Belgrave Square, S.W.1. Lecture: "Valves for low-noise wide-band width amplifiers."

By: R. J. Ballantine and W. E. Widdowson, Ph.D., A.Inst.P.

Group Secretary: J. W. Warren, Research Laboratories, The General Electric Co., Ltd., Wembley.

Institution of Electronics

North-Western Branch

All meetings are held at the Reynolds Hall, College of Technology, Manchester.

Date: October 12. Time: 7.30 p.m.

Lecture: "Electronic Developments in Instrumentation."

By: D. Edmundson, B.Sc., A.M.I.E.E.

Hon. Secretary: L. F. Berry, 105 Birch Avenue, Chadderton, Lancs.

British Sound Recording Association

All meetings are held at the Royal Society of Arts, John Adam Street, London, W.C.2.

Date: October 22. Time: 7 p.m.

Lecture and Demonstration: "The Limitations of the Loudspeaker."

By: P. S. Walker.

Hon. Secretary: R. W. Lowden, Napoleon Avenue, Farnborough, Hants.

CORRESPONDENCE - Residual Hum in Valves

DEAR SIR,—In reply to the letter published in the July issue from Dr. Grey Walter and colleagues, I should like to suggest the following explanation.

Even after all reasonable precautions, the electrode system of the valve in a first stage comes under the influence of either or both of two magnetic fields of "mains" frequency: (a) that due to a mains transformer, even if some feet away; (b) that due to the heater of the valve itself, if mains operated. In connexion with (b), it may be mentioned that a double helix heater gives less magnetic field effect than the more usual W-type of heater. This magnetic field may modulate the electron stream, causing hum, especially if there are magnetic materials forming low reluctance paths within the valve.

Nickel and iron are commonly used in valve electrode construction, and the B-H magnetisation curves of such materials have a very low slope in the region of the origin, and then rapidly increase slope as H is increased from zero. The slope, of course, decreases again towards the saturation value of B. A cyclic variation of H, as from an alternating magnetic field, will cause a cyclic variation of B in the electrode material described by a small hysteresis loop. The extreme points of this loop will lie on the steady state B-H curve just described. If the electrode material is already slightly magnetised, the loop will lie on that part of the B-H curve having appreciable slope, and an appreciable fluctuation of B will result, which may modulate the electrode stream. If the electrode material is now de-magnetised, the loop will lie on that part of the B-H curve near the origin which has very low slope, and a much smaller fluctuation of B will result, insufficient to modulate the electron stream detectably.

N.B. Permeability (equals B/H) may be taken as an indicator of the slope of the B-H curve. As an example, typical silicon steel Transformer iron has an initial permeability of about 400, and a maximum permeability of ten times this value.—Yours faithfully,

W. I. HEATH

DEAR SIR,—The letter by Dr. W. G. Walter and Messrs. Shipton and Warren on "Demagnetising Valves as a Cure for Residual Ripple" in the July issue has aroused great interest among valve users. A number have, however, drawn false conclusions, and I would like to draw attention to several points not mentioned in the article.

Measurements were made in our Laboratory on a batch of EF37's including a number of valves rejected because of excessive magnetic hum, and the effect of demagnetisation and magnetisation on the magnetic hum was observed both in triode and pentode connexions.

(All results below, it must be understood, are in the nature of generalisation, as variations between individual valves are large).

(1) Demagnetisation of valves as received produced no improvement. No evidence was found that normal production valves or rejects were initially magnetised.

(2) Magnetisation in various directions produced different results in triodes and pentodes.

(a) In triode connexion the hum often increased very considerably, for example a typical result is:

Magnetic hum, valve unmagnetised
3 μ V equivalent

Magnetic hum, valve magnetised
12 μ V equivalent,
the hum being expressed as the voltage which, when applied to the control grid, would give the measured hum component in the anode current.

(b) In pentode connexion substantial changes may occur, but such changes were found to be totally random both in magnitude and direction; thus a pentode with an initial hum of, say, 12 μ V equivalent may after magnetisation have a hum of 7, 12 or 20 μ V.

(3) On demagnetising the magnetised valves they returned to their original hum levels.

As a discrepancy seemed to exist between these results and those of Dr. Walter's, he was approached, and from the ensuing correspondence a probable explanation emerged: as Dr. Walter was using a number of Ticonal magnets in his equipment it was likely that his

valves had become magnetised by occasional proximity to these magnets during storage or in handling before use. Furthermore, he was using the EF37 in triode connexion, so that our measurements are in full agreement with the reduction he observed on demagnetisation.

In general, therefore, demagnetisation cannot be considered as a method of reducing magnetic hum in the EF37, unless the valves have previously been accidentally magnetised, and even then consistent improvement can be expected only in the case of triode connexions.

Yours faithfully,

L. H. LIGHT,

VALVE MEASUREMENT AND APPLICATION LABORATORY,
MULLARD RADIO VALVE CO. LTD.

DEAR SIR,—Mr. Light's letter contains some interesting information, and one feels that the difference between pentode and triode connexions should be an important clue to the origin of the effects under discussion.

The much higher effective impedance of the valve connected as a pentode would, of course, have an appreciable effect upon all types of hum and noise, but the exceedingly high levels of hum found in some individual valves in this class, suggests that some other effect may be present. Hum levels equivalent to 50-100 μ V are not uncommon in pentodes of the EF37 type, and the statistical distribution appears to be far from normal, so that it would seem to be worth while to inquire further into the mechanism whereby heater voltage and current modulate the electron stream in these conditions.

We certainly agree with the final paragraph of Mr. Light's letter, since it would be too much to hope that demagnetisation would be effective if the valve had not previously been magnetised. The fact remains that many valves of the EF37 and other types obtained through various channels are found to be slightly magnetised and demagnetisation of these does reduce the hum level in our amplifiers.

Yours faithfully,

W. GREY WALTER,

H. W. SHIPTON,

W. J. WARREN.

BURDEN NEUROLOGICAL INSTITUTE.