Finer Details of Radio

Correspondent Comments on Valve Curves

"RHEOSTAT" (Wadestown) writes. —I was much interested in your article on "The Three-Electrode Valve as an Amplifier," appearing in the "Radio Record" for May 10, but am somewhat at a loss in reconciling one or two points with what I have learnt regarding alternating currents. I must admit that my knowledge of radio is rather limited and not nearly so extensive as my grounding in A.C. work, but it seems to me that the principles are identical.

Your article leads one to the conclusion that the "operating point" of the valve describes a line transverse to a number of curves corresponding to the static curves of the valve with differing plate voltage—that the operating point is always on that line, only its extent of travel varying according as the signal voltage varies.

Possibly you intended to imply that the "operating curve" varied as to slope according to the frequency of the applied A.C. Would you please make me clear on this point? It seems to me that the frequency must alter the slope, as it certainly alters the impedance of the load in the plate circuit of the valve.

That is not my real difficulty, however. What is, is this: The load in the plate circuit of the valve is surely almost wholly inductive, since the grid to filament resistance of the next succeeding valve is, or should be, practically infinite. This will result in the current being considerably out of phase with the voltage. Since the load is inductive, the current will lag the voltage, the extent of the lag being dependent on, among other things, the frequency of the applied voltage since the ratio of inductive to resistive load will be varied thereby. Assuming that it is true that the current lags the voltage it seems to me impossible that the path described by the "operating point" can, even for a single frequency, be in the form of a single finite line. The voltage across an inductive load is a maximum when the current is changing most rapidly. In dealing with a sine wave, therefore, the voltage is a maximum when the current is a minimum—that is, when the operating point has, after its excursion towards positive grid voltages, returned to its initial position, or, to be more accurate, a point vertically above its initial position.

Since the load is not wholly inductive, the maximum voltage will be reached somewhat before this point, but my idea is that the voltage applied to the plate, and consequently the plate current, must be a maximum, not when the negative grid voltage is a minimum, but some time after the grid voltage has commenced to retreat to its former position. Applying the same reasoning at different points of the cycle, it seems to me that the path traced by the "operating point" for any single frequency and applied voltage must be of an oval shape.

"Pentode" Replies.

OUR correspondent is, of course, correct on both counts. It will be obvious, from an elementary consideration of resistance-capacity coupling, that the slope of the operating curve of a valve varies with the resistance (or impedance) in the plate circuit, the slope becoming less with an increasing resistance. Since an inductance possesses an impedance varying with frequency, the slope of the operating curve will clearly lessen at the higher frequencies when the impedance is a maximum.

The fact that the "operating point" of a valve with an inductive load describes an ellipse is also well-known. At the same time, we do not think that a discussion of a question of this character has its proper place in a journal having a popular appeal; and since the "operating curve" described in the article in question lies wholly within the described ellipse for any particular frequency, it seems that the simplification attempted has some justification. In passing, it may be pointed out that the shape of the ellipse varies with frequency, so that to attempt a full treatment would involve considerable space and the risk of confusing readers unduly.

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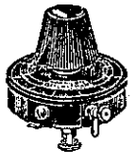

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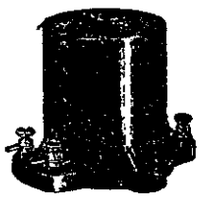

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Radio Programmes

What England Spends

SOME figures from London recently give an idea what percentages of the license revenue are spent by the British Broadcasting Corporation in programmes, management, and engineering, states an Australian journal.

The net revenue received by the B.B.C. for license fees for the year just ended was £771,763, of which 68.54 per cent. was spent in programmes, copyright fees, etc. Plant maintenance, engineering, and other details associated with the transmission of the programmes showed a percentage of 20.8 per cent., and the balance of the license revenue, 10.66 per cent., goes towards the cost of management and other expenses. In addition to the revenue from license fees the B.B.C. made £120,000 clear profit from the various publications controlled by them.

This gives a basis upon which to compare the conditions laid down in the tender which is being called for the provision of programmes throughout the whole of the Commonwealth for the next three years.

In Australia, the Commonwealth Department will take 40 per cent. of the license revenue (8s. from each license fee) for the engineering and plant maintendance, the building of relay stations, and the provision of trunk lines, etc. This compares with 20.8 per cent. used by the B.B.C.

This will leave for the successful programme contractor 60 per cent. of the license fees, or 12s. in the £1, to provide programmes, copyrights, management, and certain mechanical costs. Against the 60 per cent. available here for those channels, the B.B.C. spends nearly 80 per cent., and as they have a complete network of stations to operate with, it is possible to relay the greater portion of the London programme to the majority of the provincial stations.

The programme contractor for the national broadcasting scheme will have eight stations at the present moment to cater for, with nearly 300,000 listeners spread over the huge are of the Commonwealth, and with less than a quarter of the revenue available to those controlling wireless in England, he has to spread his programme over three million square miles of country, finding sufficient talent in every State of the Commonwealth to furnish a daily programme which, in the aggregate, will total 75 hours per day.

Valve Developments

Review by Dr. Fleming

DR. J. A. FLEMING, the famous scientist and inventor of the thermionic valve, has recently given a review of the subsequent development of his invention, together with some observations as to the possible future lines of discovery. Coming from one so intimately associated with the subject as Dr. Fleming, these remarks are of peculiar interest.

You will remember that he discussed the question as to the source of the electrons which are emitted from the filament of a radio valve. It would appear that in the case of a pure metal filament—tungsten, for example—heated by an electric current in a high vacuum, the electrons which escape from the filament as thermions are simply the free-moving electrons which are considered to move in the inter-atomic spaces, and which are responsible for metallic conduction.

If this theory be correct, then obviously the electrons come originally from the batteries. You will find it very interesting to consider whether they come from the low-tension filament heating battery, or from the high-tension battery. As you know, you can get a considerable amount of electron emission by the use simply of a low-tension heating battery without any high-tension battery at all, and therefore in his case it is clear (assuming the electrons are not due to changes in the atoms of the filament themselves) that they come from the filament heating battery.

On the other hand, where a high-tension battery is used, it is clear that this passes a current between the filament and anode, which current consists of an electronic stream, and, therefore, it is reasonable to suppose that the current comes from the high-tension battery.