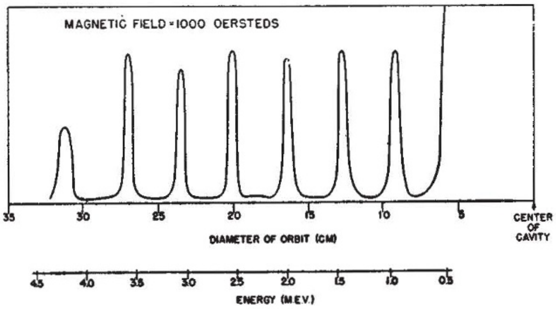

Fig. 2

amplified and fed to a recording meter. Fig. 2 shows a typical plot of the current collected as a function of the distance from the slit to the centre of the cavity Although the eighth orbit appears broadened due to its proximity to the edge of the magnetic field, there is little, if any, loss of current between orbit 2 and orbit 8.

Instead of the sharp resonance at 1,000 oersteds to be expected from (1) and (2), the resonance value of the magnetic field is found to be broad, and with a particular cavity eight successive orbits are obtained for values of the magnetic field anywhere between 900 and 1,200 oersteds. We have no adequate explanation of this, but believe it is connected with the possibility that electrons with the required phase may cross the first gap with a range of energies. In this way it is possible to satisfy (1) and (2) simultaneously for a range of magnetic fields. It may be possible to make use of this phenomenon in future designs to permit the use of higher magnetic fields and cavity voltages.

In addition to the main resonance, other modes of resonance operation at lower magnetic fields are also observed. These may be identified with the resonance conditions when $\gamma = 2, 3, 4, \ldots$, and the time difference between successive orbits is $2T, 3T, 4T, \ldots$

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Sea Waves and Microseisms

IT is well known[1] that the pressure variations beneath a progressive gravity wave of Stokes's type are insufficient, in deep water, to generate microseisms of the observed magnitude. This is because the pressure variations on the sea-bed decrease exponentially with the depth. The following argument, however, shows the existence, in a general class of wave motions, of 'second-order' pressure variations which are not attenuated with the depth.

The surface elevation in a simple stationary wave, for example, is given, in Lamb's notation[2], by

$$(A) \qquad \eta = a \cos kx \cos \sigma t + O(a^2),$$

where

$$\sigma^2 = gk \tanh kh.$$

Consider the mass of water contained between the bottom $z = -h$, the surface $z = \eta$ and the two vertical planes $x = 0, \lambda$ where $\lambda = 2\pi/k$. There is no flow across the vertical planes and therefore this mass of water consists always of the same particles. Therefore, if F is the vertical component of the total external force acting on the mass, we have, summing the equations of motion for each particle of mass m and cancelling internal forces,

$$F = \Sigma m \frac{d^2 z}{dt^2} = \frac{1}{g} \frac{d^2}{dt^2} \text{ (potential energy)}.$$

Now the forces across the vertical boundaries contribute nothing to F; the pressure p_0 at the free surface contributes a downwards force λp_0 and gravity a constant force $\lambda \rho g h$. Hence

$$F = \lambda(p - p_0 - \rho g h),$$

where p is the mean pressure on the bottom. Now for the stationary wave (A) we have, neglecting compressibility,

$$\text{potential energy} = \int_0^\lambda \tfrac{1}{2} \rho g \eta^2 \, dx$$

$$= \tfrac{1}{4} \lambda \rho g a^2 \cos^2 \sigma t + O(a^3).$$

Hence

$$(B) \qquad \frac{p - p_0}{\rho} = gh - \tfrac{1}{2} a^2 \sigma^2 \cos 2\sigma t + O(a^3).$$

The second term is of order (wave-height)^2, which explains why it is not revealed in the ordinary first-order theory. It is also of double the fundamental frequency and, for a given frequency and amplitude, is independent of the depth h. Equation (B) has been derived by Miche[3] in the course of a complete evaluation of the second approximation to the stationary wave-motion. By a slight extension of the present argument one can evaluate the mean pressure below the series of long-crested waves given by

$$(C) \qquad \eta = \sum_{m,n} a_{m,n} \cos (mkx + nky + \sigma_{m,n} t + \varepsilon_{m,n}),$$

where m and n are integers and

$$\sigma_{m,n}^2 = (m^2 + n^2)^{1/2} gk \tanh (m^2 + n^2)^{1/2} kh, \quad (\sigma_{mn} \geqslant 0).$$

If p is the mean pressure on the bottom, we find

$$(D) \qquad \frac{p - p_0}{\rho} = gh -$$

$$\sum_{m,n} a_{m,n} a_{-m,-n} \sigma_{m,n}^2 \cos (2\sigma_{m,n} t + \varepsilon_{m,n} + \varepsilon_{-m,-n}).$$

Hence this type of pressure fluctuation occurs whenever wave-trains cross which are of the same frequency and travel in opposite directions (corresponding to integers (m,n), $(-m,-n)$). A single wave train gives zero fluctuation in the mean pressure.

These results provide the basis for a new theory of microseism generation. They explain how microseisms come to be generated in deep water[4,5], and why the frequency of the microseisms is sensibly double that of the waves associated with them[6]. The theoretical orders of magnitude are in agreement with those observed. A fuller account of the theory is in preparation.

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