By simply raising or lowering the point *B*, by means of the adjustable support *E*, a long or short illumination period may be obtained. The drum is adjusted to the particular time of day requiring illumination, and the clock wound once each week.

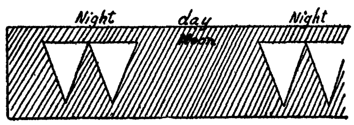

Fig. 2.

If illumination is required for any length of time during two or more different periods of the day, the band of fiber paper is cut accordingly. Figure 2 represents the type of band for any length period of morning and evening illumination.

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CENTRIFUGING FILTERABLE VIRUSES

FROM time to time there have appeared experimental reports in which attempts to concentrate filterable viruses by the centrifugal method have been described. Particles of such small size are incapable of any great velocity of sedimentation even when acted upon by centrifugal force. In a general sense, the same is true of bacteria.

By Stoke's law; the velocity $\mathbf{v}$ of a sphere of radius r and of density Δ falling under gravitational acceleration g in a liquid of density δ and viscosity η is:

$$\mathbf{v} = \frac{2r^2 g(\Delta - \delta)}{9\eta}$$

Substituting for g, gravitational acceleration, the centrifugal acceleration—

$$\omega^2 R = 4\pi^2 RP^2$$

where ω is angular acceleration, R is the radius of curvature (from the center of the centrifuge to the particle), and P is the angular velocity, or revolutions per second, we have:

$$\mathbf{v} = \frac{2r^2(\Delta - \delta)}{9\eta}(4\pi^2 RP^2) = \frac{8\pi^2 r^2 RP^2(\Delta - \delta)}{9\eta}$$

This, then, is the general equation.

Let us now solve for $\mathbf{v}$ in a general problem. We assume a virus particle 5×10^{-6} cm. in radius ($0.1\,\mu$ diameter), spherical, of density 1.1.[1] Let it be suspended in a liquid of density 1.0 and located 20 cm. from the center of the centrifuge. Let the viscosity be 0.01 (water at 20° C.) and the speed be 3,600 r.p.m. (P = 60). Then:

$$\mathbf{v} = \frac{8\pi^2(5 \times 10^{-6})^2 \times 20 \times 60^2(1.1 - 1.0)}{9 \times 0.01}$$
$$= 158 \times 10^{-6} \text{ cm./sec. or } 0.57 \text{ cm./hr.}$$

This velocity is certainly not great, since under the conditions stated some 8.8 hours of centrifuging would be necessary to carry a particle 5 cm. And if analysis is made of the values used in this problem it will be seen that they are taken to give $\mathbf{v}$ a probable maximum value. The viscosity in practice is ordinarily greater than that of water, and the radius of the particle is almost unquestionably less than 5×10^{-6} cm. Ordinarily centrifuge methods applied to filterable viruses are from the standpoint of physical laws of questionable value.

The surface-volume relationship in the illustration problem is such that a 1 cc. volume would have to be contained in a film less than a micron thick and over half a meter square to give relatively the surface exposure, considering both sides of the film. Or a centimeter cube with its 6 cm.[2] surface would have to have a density about 1/100 that of air to give the same surface-mass relationship as pertains to the minute particle described.

Thanks are due to Mr. W. W. Sleator of the laboratory of physics of the University of Michigan for checking and correcting this problem.

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[1] Investigation of a number of references on the density of bacteria gives various figures. A density of 1.1 is considered a fair average.

PERSIMMON SEEDS FOR CLASS USE

AN examination of the seeds of the common persimmon, *Diospyros virginiana,* convinced the writer that they should make excellent class material for embryological studies as well as for studies of the structures of a thick-walled endosperm. The comparatively large, straight embryo is easily removed from the endosperm and its parts are easily seen. Younger stages should make good microscopic preparations for embryological work, provided that the difficulties encountered in cutting the testa and endosperm are not too great. Carbohydrate is apparently stored in the thick cell walls of the endosperm in the form of cellulose or hemi-cellulose, and this being the case, the germinating seeds should be a good source of cytase-like enzymes.

During the past season the writer sent a supply of persimmon seeds to Dr. E. M. Gilbert, of the department of botany of the University of Wisconsin, who writes that they have been used successfully in