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.

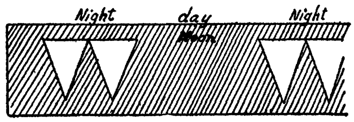

Fig. 2.

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:

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

Substituting for g, gravitational acceleration, the centrifugal acceleration—

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

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:

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

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:

$$\mathbf{v}=\frac{8\pi^2(5\times10^{-6})^2\times20\times60^2(1.1-1.0)}{9\times0.01}$$
$$=158\times10^{-6}\text{ cm./sec. or }0.57\text{ cm./hr.}$$

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 several classes for embryological work and for studies of the thick-walled endosperm. Dr. Gilbert further states that the walls of the endosperm have proved to be unusually good material for the study of the plasmodesmus.

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SPECIAL ARTICLES

THE OCCURRENCE OF THE PLATINUM METALS

RECENTLY I have had the opportunity of studying the results of some forty analyses of the Canyon Diablo meteorite, both of the iron and of the so-called shale-balls. The latter appear to be merely the oxidized iron, as some of them still have an unoxidized iron core. The analyses were made by at least eight different analysts, including Dr. J. W. Mallet, H. H. Alexander, A. H. Phillips, G. H. Clevenger and myself, and included the content in platinum, iridium and in some cases palladium.

There have been but two references in literature to the occurrence of platinum in meteorites.[1] Trottarelli reported palladium in the Collescipoli stone, and J. M. Davidson found the Coahuila iron to contain 39 parts per million of platinum and 2.44 parts iridium. In the Toluca meteorite sufficient platinum was found to give a precipitate of potassium chloroplatinate, which from its color probably contained iridium. No quantitative estimation was made.

The Canyon Diablo analyses, weighted according to my best judgment, average as follows:

Platinum	11.2 parts per million
Iridium	5.8 parts per million
Palladium	2.1 parts per million

The ratio of platinum to iron in the shale-balls corresponds closely to that in the unoxidized meteorite, the ratio of iridium to iron is lower and that of palladium to iron somewhat higher.

The average amount of nickel found in all the analyses, not weighted, is 6.44 per cent. Clarke gives the average nickel for 318 meteorites as 8.52 per cent., and in the Ovifak iron 2.95 per cent.

It may be considered probable that platinum, and doubtless all the platinum metals, would be found in all meteorites if analyses were made with this end in view, though the estimation of three or four tenths of an ounce of platinum and iridium to the ton of meteoric iron is no simple task. It may be noted that in dissolving the iron in either sulfuric or in hydrochloric acid, some of the platinum and iridium will go into solution, and this doubtless accounts for the varying results on the Canyon Diablo iron where such a method has been used.

Attention has been called by many observers to the association of the metals of the eighth group in nature. In 1891 Daubrée and Meunier noted the occurrence of metallic iron containing traces of platinum in the gold washings of Berazovsk in the Ural, and also that many meteorites resembled rocks with which platinum is generally associated in nature.

It may be worth while to attempt a rough approximation of the relative amount of the metals of the eighth group, assuming that the iron of the interior of the earth contains the same proportion of the platinum metals as the Canyon Diablo meteorite.

For this we can use the calculation of F. W. Clarke for the earth as a whole:

Iron	67.2 per cent.
Nickel	4.0 per cent.
Cobalt	.277 per cent.

Average cobalt in 318 meteorites: 0.59 per cent.

Clarke gives the analyses of 8 native platinums and 3 iridosmiums, and Kemp gives 42 analyses of native platinum and 12 of iridosmium. From these we derive the following weighted averages:

	Native platinum	Iridosmium
Platinum	89.88	.48
Iridium	4.88	60.37
Osmium	1.92	33.53
Rhodium	2.47	3.59
Palladium	.83	Trace
Ruthenium	.011	2.05

Recent figures[2] give the composition of Russian crude platinum as: platinum, 83 per cent.; iridium, 2 per cent.; palladium, 0.5 per cent.; rhodium, 0.6 per cent.; iron, etc., 13.9 per cent. It is doubtful if these figures can be relied on as general.

An approximation of the amount of iridosmium compared with platinum can be made from the amount produced over a long period of years. The present proportion (1925) of 9 per cent. as much iridosmium as platinum is obviously too large, owing to the stimulation of production by the abnormally high price of iridium, while the earlier production of 1 per cent. to 3 per cent. is as obviously low, from the slight market demand for iridosmium and the metals obtained from it. We may fairly assume 5 per cent. as about the proper proportion of iridosmium to platinum. On this basis, our figures for

[1] Trottarelli: *Gazz. chim. ital.* 20 (1890), 611; Davidson: *Amer. J. Sci.* (4), 7 (1899), 4.

[2] *Afr. Mining Eng. J.* 38 (1927), 123.