at Wolfeboro, N. H., have been found to reveal a logging operation between the growing seasons of 1794 and 1795. The evidence for it appears in the sudden "release" of the then small hemlocks, as shown by the change from suppressed growth and very narrow rings to normal growth and broad rings after 1794.

Although such evidence of release of young trees by removal or death of much larger trees is commonplace to students of forestry, it is thought that the observations here recorded form something of a record in that they date an event in the eighteenth century. A total of 129 annual rings had been formed under the new conditions by each of the six trees chosen at random from about ten times as many cut early in 1924. This precise agreement showed that the release was not due to natural causes but to an act of man, and the history of the site confirmed the idea because it was then adjacent to the cultivated land on the well-known estate of John Wentworth, provincial governor of New Hampshire. From our analyses of other hemlocks on other sites, the release of individual young trees is evident, but, even though growing within a few rods of each other, their sudden increases in rate of growth occur in different years.

It is also possible to make a preliminary announcement that this study of climatic effects on growth rates of the hemlock, *Tsuga canadensis,* has produced positive evidence in favor of a marked control of growth by rainfall *during the growing season.* Drouth years in particular are marked by narrow rings, while seasons with abundant rainfall usually give relatively wide rings. Since the trees used for analysis have as many as 335 rings of wood, the results should add to our knowledge of rainfall in New England well back into the seventeenth century.

This work is being supported in part by a grant from the American Association for the Advancement of Science, and a detailed report of it will appear later. In the meantime, information concerning old growth hemlock stumps and butt logs in New England (with known dates of cutting) will be welcomed as an aid to the collection of accurate data from widely separated sites in the area.

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NATIONAL WELFARE, BUSINESS PROFITS AND INDIVIDUAL BENEFIT

IN an admirable article in SCIENCE (Vol. 81, No. 2090, January 18, 1935, pages 55–62), Professor Wesley Mitchell has presented what may eventually be considered the definitive case for national planning. Although he has neglected the vital distinction between an *oligarchic* "planned" society and a co-operative or *democratic* "planning" society, Professor Mitchell has, I think, demonstrated the inevitability of some kind of large-scale social planning. By whom and for whose good the planning shall be done now becomes the crucial issue.

I am, however, concerned by Professor Mitchell's apparent retention of an outworn theory of motivation as the psychological basis for economic behavior. He states that the "*application* [of scientific discoveries] has been effected *mainly* by men who were seeking profits." By implication, these fundamental discoveries themselves were *not* made because of the driving power of the profit motive. Granted that capitalistic enterprise since the industrial revolution may be equated with the "profit system," it is a defective picture of human nature to assert that even the work of the competitive business world has ever been *mainly* performed under the incentive of profits. At least 95 per cent. of the people (in which I would include most of the readers of SCIENCE) make no "profits" in the technical meaning of the term as the positive difference between sales price and cost of production, including administrative salaries. They do, however, secure personal "benefits" and "advantages," *i.e.,* individual "gains," which are an altogether different matter. Human needs demand gratification, but the "need" for profits is a feeble acquired want in most men. The mere existence of technicians and professors who are gratified by an elevation in rank with an accompanying drop in compensation (not a rare combination in recent years!) is sufficient refutation of the strength of the "profit" urge among applied scientists. Certainly industrial psychology and personnel management would be non-existent fields if the lure of an excess monetary reward were the only, or even the principal, factor making for cultural advance.

Economists, executives and advertisers are keenly aware of the reality of "non-financial" incentives. It is, therefore, all the more strange that in philosophizing about the present social order, so many of them make such an inadequate and false distribution of emphasis in cataloging the motives underlying their own activities.

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CHINESE MAGIC MIRRORS

A RECENT news item in the *Herald-Tribune* of New York was to the effect that certain scientists had started an investigation as to how the Chinese magic mirrors were constructed. This interested me very much, for I recall how the late physicist, Dr. Thomas Corwin Mendenhall, with whom I was associated on the board of trustees of The Ohio State University, had become interested in the same question while teaching in Japan, how he had discovered the secret of such magic mirrors, then accidentally made, and how he had demonstrated their manufacture as a possibility. In honor of this discovery the university annual published by the students of Ohio University was called *Makio,* which, I am told, is Japanese for magic mirror.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

HIGH ROTATIONAL SPEEDS IN VACUO

THE need for some simple, inexpensive method of producing high rotational speeds in vacuo has frequently been felt in many fields of experimental science. The air-driven ultracentrifuge has been adapted to supply such a demand. A brief description of its basic features may prove of value.

The rotating member consists of three main parts: (1) a small, conical, air-driven, air-supported turbine;[1] (2) a much larger and heavier rotor of any desired shape, which spins in the vacuum chamber; (3) a steel piano wire extending vertically downward along the axis of rotation from the vertex of the turbine above the vacuum chamber to the larger rotor which it supports and drives. A cross-sectional view of the rotating member, the turbine stator and the cylindrically shaped vacuum chamber is given in Fig. 1. The wire enters the chamber through a special type of brass gland with two holes that leave very slight clearances. Viscous oil slowly forced by a gravity feed into these clearances both lubricates the gland and serves to make it vacuum tight. This lubrication and the small diameter of the wire reduce friction losses to a negligible amount.

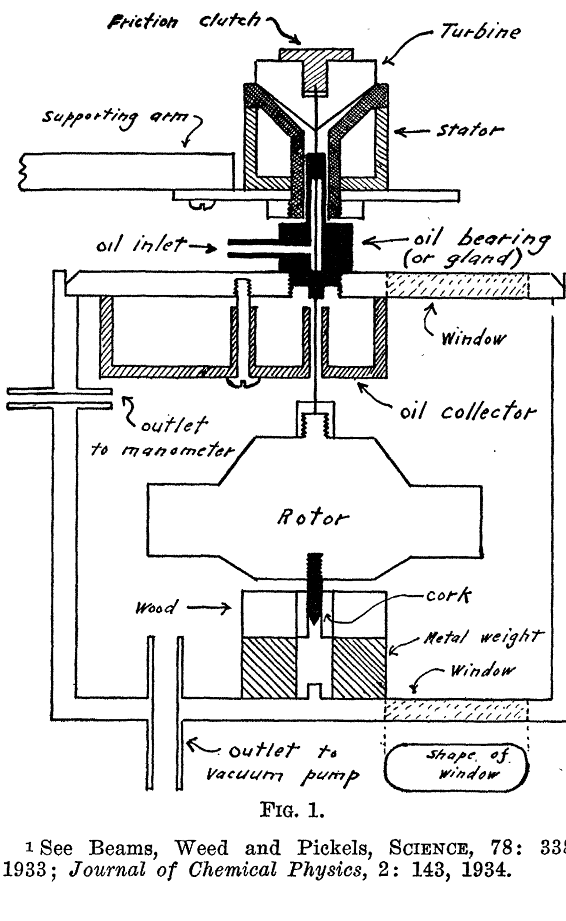

FIG. 1.

[1] See Beams, Weed and Pickels, SCIENCE, 78: 338, 1933; *Journal of Chemical Physics,* 2: 143, 1934.

To prevent sudden accelerations or decelerations from excessively twisting the wire, it is not fastened to the turbine proper, but passes through a small hole along its axis and is clamped to a friction clutch. The stator is supported by three arms made of light, stiff strips of channel brass, each flexibly mounted and about 6 inches in length. They are provided with ample adjustment for centering, raising or lowering the stator. Fastened to the top, inside the vacuum chamber, is a circular, cup-like container to collect any oil leaking from the gland. A very small disk (not shown in the drawing) attached to the wire just below the gland will throw this oil into the collector and prevent its reaching and clouding any windows in the apparatus. Below the rotor is a circular block composed of metal, wood and cork and arranged as shown in the figure. The rotor is supplied with a steel tip fitting loosely enough into the cork for friction to be negligible. The block is free to move about on the floor of the chamber within a limited range so that it will automatically settle into the correct position when the rotor is spinning. It is heavy enough, however, to prevent undesired precessions from being set up by the rotor.

The rotor becomes vibrationless soon after the turbine is started and the air pressure has been raised sufficiently to support it. It might be noted that great precision in machining and balancing the rotor is not essential, as was well attested by the smoothness with which a 3-inch steel rotor spun after having a ¼-inch hole drilled near the periphery. An air turbine weighing less than 50 grams will rotate an 800 gram rotor at a speed just slightly less than that of the turbine alone. The unguided sections of the wire are not long enough to permit objectionable standing waves being set up. The vacuum obtainable is apparently limited only by the slight vapor pressure of the oil. Oil consumption in the gland amounts to less than 1 cc per hour. In stopping the rotor, wear on the turbine and stator can be minimized by lowering the stator and allowing the rotor to drag on the wooden block below it. Windows are conveniently