From the descriptions given it is not clear that the phenomena described by Professor Gaehr and Mr. Packard are of the same class as those described by Dr. Gradle. A momentary appearance of the spokes of a rapidly rotating wheel which might be described as stationary may be caused by an eye movement, voluntary or involuntary, in which case the explanation falls under (1) given above. It is possible, however, that there is presented here a special case of a phenomenon which has been variously called the Purkinje after-image, Bidwell's ghost, recurrent vision, etc. The variations in this phenomenon which may be produced by varying conditions are well known to be numerous and complicated and the pulses of sensation which occur are at least remotely suggestive of the possibility of stroboscopic effects.

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QUOTATIONS

THE MINIMUM LIVING SALARY OF THE PROFESSOR

A RECENT contribution to SCIENCE presents for inspection the budgets of 50 per cent. of the married members of the University of California faculty. The schedules of ninety-six householders were available. The average family consisted of 3.5 persons, and the expenditure of this fractional group averaged $5,000 per annum.

Needless to say, salaries alone did not provide this amount: indeed, in three quarters of the cases salaries did not pay for the goods and service regarded as necessaries. Seventy-five per cent. of the faculty families had to supplement the professional wage with other earnings. The mean cost of living for the ninety-six households proved to be $5,511.77; generally speaking, the professors spent $7,000 and the instructors $4,000.

To summarize: These families, at every income level, spent 17 per cent. of their budget on food, 17 per cent. for shelter, 9 per cent. for clothes (in 40 per cent. of the cases the wives spent less than their husbands), and for the items of investments, automobiles, health, recreation and dependents outside the home an average of one fourth to one third of the total expenditure; 57 per cent. had automobiles, one third had dependents outside the home. House operation took 13 per cent., though no family living on less than $6,000 had full-time domestic help. Education took 1.5 per cent. of the total; church, charity and tobacco absorbed less than 1 per cent. The standard and cost of living disclosed in this article are minimum for professional men; $5,000 was the minimum cost of health and decency, yet in most cases it was obtained only by extraordinary exertions.

These are home truths for members of the teaching profession, but they apply with only slightly diminished force to members of other professions and to married graduates from two to twelve years out of college who have not yet had time to become established in their calling. The salaries of young men in any profession have shown little or no response to the increasing cost of living. And, to make up the deficit, the wage-earning wife is, at best, a happy accident. For young couples, whether in the teaching profession or not, the problem of how to live on $5,000 a year—with a household of three and a half persons more or less—has never been more acute. There is some compensation perhaps in the fact that professors and, as one might say, other men of parts are in the same boat, but no comfort at all in the reflection that Mr. Ford and other high-paying industrialists, by raising the standard of wages, have boosted the cost of living and made the going even rougher than usual for the poor professional man. Even worse off, probably, are the hundreds of thousands of Americans who are employed in unskilled, non-unionized occupations and have no opportunity to increase their incomes.—*The Harvard Alumni Bulletin.*

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN EGG SHELL VALVE

DURING and since the World War more research has been done upon the various phases of the physiology of the respiratory system than in all the previous history of physiology. In the study of many respiratory phenomena it has been found necessary to control the direction of air currents by means of valves. Even though a considerable number of types of valves has been described for this purpose, the writer wishes to present another which has proved quite satisfactory. The valve itself consists of the dried shell of a hen's egg which has been rendered impervious to water by several coats of celluloid cement.

After opening the large end of the egg to remove the contents the shell is thoroughly dried, coated several times with a cement made from celluloid dissolved in acetone or other nitro-cellulose product, dried and trimmed with small scissors to the shape shown in Figure 1, *B*. Any rough edges may be repaired by binding with lens paper moistened with the cement. The shell is then fitted with an aluminum wire stem and a cork counterpoise as shown in the figure and is ready for use.

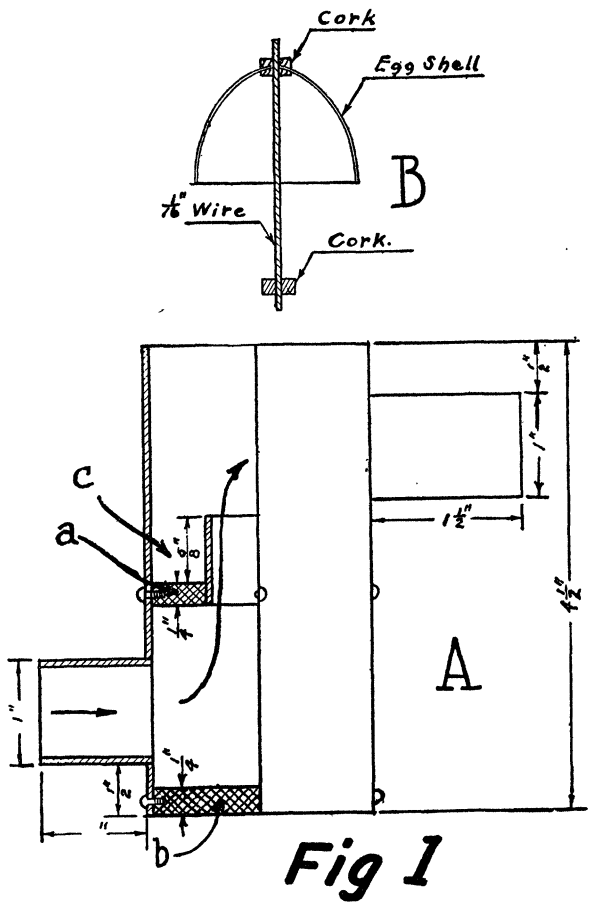

Fig 1

The valve chamber, Figure 1, *A*, consists of a short length of nickeled brass pipe cut from what plumbers designate as a two-inch tank L. This pipe is fitted with two brass discs, *a* and *b*, the latter of which closes the lower end of the chamber while the former forms the floor of the circular mercury well, *c*. As shown in the figure, a short length of one-inch brass pipe soldered in place serves for the inner wall of the mercury well. The discs, *a* and *b*, may be held in place by means of round head brass screws or may be soldered.

The direction of the air current is shown by means of the arrows. The entrance and exit tubes are of one-inch brass tubing. Before assembling for use the interior of the valve chamber must be thoroughly coated with hard paraffin or beeswax to prevent the mercury from corroding the soldered joints. The valve chamber may be readily held in its proper position by means of one or more screws passed through the disc *b*. In this laboratory the two valve chambers and the absorber chamber are compactly assembled upon a brass plate which in turn is supported by short pipe legs and mounted upon a wooden base by means of stove bolts. The upper end of the valve chamber is closed by means of a No. 11 rubber stopper. This allows for convenient examination and adjustment.

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SPECIAL ARTICLES

THE HEME COMPOUNDS IN NATURE AND BIOLOGICAL OXIDATIONS[1]

THE new knowledge of the existence and function of the heme compounds in aerobic tissues generally brings together two problems which at first sight seem far apart, the problem of the peculiar biological distribution of the hemoglobins, which are found only in a few groups of unrelated animals, and the problem of the nature of the iron compounds which catalyze biological oxidations.

Heme is the iron pyrrol complex which is joined to the protein, globin, in hemoglobin. It may be prepared in the form of its crystalline chloride, hemin. The blood of every vertebrate contains hemoglobin. Without such a pigment the large active vertebrates could not exist. But outside of the vertebrates hemoglobin occurs only here and there and in the most widely different animals. Its completely haphazard distribution does not follow at all the genetic relationships. Apparently a very complicated substance has arisen independently in nature again and again. Apparently when an individual species requires hemoglobin it can create heme to fill its need.

The ordinary fuel substances which are very stable when exposed to air *in vitro* are burned in the living organism with great ease due to the aid of catalysts. It has been believed that heavy metal compounds, in particular iron compounds, are concerned in this catalysis. But the only fact that has been known about the nature of the iron compounds which exist in all tissues is that one can not get a test for free inorganic iron. Yet the properties, catalytic and otherwise, of an iron compound depend to a great extent on the nature of the complex to which the iron is attached. Small changes in the nature of the complex can cause big changes in the powers of the catalyst.

The conclusion we wish to present is that the iron pyrrol complex, heme, is present not only here and there as a constituent of hemoglobin, but in the oxygen-consuming tissues of animals and plants generally, and that the heme compounds in nature are intimately concerned with the catalysis of biological

[1] Based on a lecture given in Evanston, Illinois, on August 11, 1928, before the Institute of Chemistry of the American Chemical Society.