no change. A few minutes later the temperature of the middle and opposite sides of the stream was 16°, on the geyser side 17°.

At the foot-bridge, one hundred yards down stream from the overflow of Excelsior Geyser, shortly before an eruption took place, the temperature of the water on the geyser side in shallow water was 35°. A little farther out in deeper and swifter water, 32°; on the opposite side near shore 22°. Here the water was unmixed with geyser water and the bottom was dark colored. Where warm water runs the bottom is lighter colored. Soon after these temperatures were taken there was an eruption of the geyser, when a large flow of boiling hot water entered the stream. Immediately after the eruption near the geyser shore the temperature was 55° at the point where it had been 35° before the eruption. On the opposite side of the stream near shore there was no change of temperature.

Life, both animal and plant, had been killed by the hot water in the center and on the geyser side of the stream for a distance of probably as much as a half mile down stream. On the opposite side of the stream neither animal nor plant life had been affected by the hot water. For example, tubes of caddis-fly larvae, built of pine needles, and suggesting the stick-chimneys of log-cabin days, were abundant on stones everywhere on the bottom of the stream from shore to shore. The larvae in tubes on the side of the stream opposite the geyser were living and active. Those in the middle of the stream and on the geyser side were dead.

Some idea of the immense volume of water which enters the Fire Hole River from Excelsior Geyser may be formed when it is noted that the stream at this point is nearly one hundred feet wide, with an average depth of some eighteen inches and with a swift current.

Some fifteen or twenty minutes after the eruption the warm side of the stream had cooled down to 23°.

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INTERMITTENT VISION

IN SCIENCE for October 26, Dr. Harry S. Gradle asks for an explanation of phenomena which he observed as a passenger on the air mail. In a later issue of SCIENCE Professor Gaehr and Mr. Packard describe phenomena which they believe to be of the same general class. In explanation of the phenomena described by Dr. Gradle I have the following comments to offer:

(1) When successive impressions are given to any portion of the retina at a rate which produces a fused or continuous sensation, a quick lateral movement of the eye causes momentarily a resolution of the fusion into the component sensations. For example, if blue and yellow sectors are combined to gray on a rotary color mixer, a quick movement of the eye momentarily resolves the gray surface into the component blue and yellow sectors. The reason for this is obvious. The movement of the eye momentarily interrupts the succession of the impressions on any given portion of the retina, therefore the combination of impressions is prevented and the components are sensed as separate. This resolution of the fusion into its component sensations can be produced in other ways which interfere with the succession of impressions on the same portion of the retina, *e.g.,* by moving a pencil or light wand rapidly back and forth between the eye and the rotating disk near to the surface of the disk, by rotating a sector or sectors in front of the disk, etc. From these considerations we would expect the blades of the propeller to become momentarily visible when a quick lateral movement of the eye is made.

(2) The rate of succession needed to give a uniform, continuous sensation varies from the center to the far periphery of the field. Over portions of the peripheral field a more rapid rate of succession is needed to obliterate all trace of separateness of impression than is required at the center of the field. Over such portions of the field one would expect therefore to see the blades of the propeller in a flickering succession when the rate of rotation is sufficiently high to produce a fused or continuous impression at the center of the field. These conditions would apply to Dr. Gradle's observation in case an excentric fixation was taken and held.

(3a) With a far fixation and relaxed accommodation the size of the pupil is increased, the amount of the increase varying with the intensity of illumination present. An increase in the size of the pupil would cause a proportionate increase in the amount of light entering the eye. With increase of intensity of light the rate of speed of succession needed to give a continuous impression is greater. An increase of intensity of light due to an expanded pupil should therefore tend to resolve a continuous impression into a flickering succession of impressions. (b) An increase of intensity of light also causes an increase in the difference in sensation aroused by two surfaces of a given difference in coefficient of reflection. This would tend to increase the visibility of small and shadowy physical differences in the field in objects not near the threshold of acuity.

(1) and (2) above are based on direct experimental evidence. (3) is an inference from experimental data at my command.

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.