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Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 1039.

For the Week Ending November 30, 1895.

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THE BOTTLE THAT CANNOT BE REFILLED.

We published not long ago a quotation from one of our city papers, in which the statement was made that a large reward had been offered by wealthy distillers and brewers for the production of a new invention, such as that above mentioned, namely, a bottle which, after the contents have been extracted, cannot be again refilled. The article we alluded to stated that distillers suffer great losses from the refilling of their bottles by unauthorized persons, who imitate both bottles and trademarks of standard makers without detection.

We have been unable to trace up the alleged offer of reward to any reliable source and think it doubtful if it was ever positively made. But there is no doubt the invention is needed and would command a handsome figure, if all the conditions could be realized and a non-refillable bottle could be produced adapted to the general wants of the trade. As an evidence of this we give an extract of a letter recently received by us from the proprietors of one of the largest whisky establishments in the country. This letter reached us during the progress of our search to find the offerers of the alleged great reward:

"In reply to your favor, we beg to state that we have been in the market for years for a bottle that could not absolutely be refilled; but we have come to the conclusion that we cannot obtain such a bottle; for if a bottle was made so perfect that you could not refill same through the neck of the bottle, the bottle could be drilled or cut, and then refilled and closed so as to avoid detection."

LATITUDE NOT FIXED, BUT VARIABLE.

It will now and again happen to the seeker after knowledge that he will have to unlearn as well as to learn; but it will be a rare experience for him to have to call in question such a supposedly fundamental truth as that of the invariability of the earth's latitude.

If there is one fragment more than another of our childhood's "geography lesson" that abides ever with us, it is this: that "the earth turns upon its axis." And now we are told that it does not, and that, as a consequence, it is literally true that the parallels of latitude are perpetually shifting—not much, it is true; but sufficiently to make it comically possible, as was once suggested, that certain dwellers in the proximity of the Canadian border line never know for more than six months together in which country they live.

The axis of the earth, or, to speak more accurately, the axis of the earth's figure, is an imaginary line, passing through the center of the earth, and terminating at its two flattest points, known as the North and South Poles. Up to the year 1888, it was supposed that the earth rotated about this axis. If this had been true, the latitude of any given spot, as determined by observation, should have been invariable. As a matter of fact, it had been noticed, even as far back as the last century, that there was a slight, but perceptible, variation. The latitude of a given spot, as shown by two observations taken at different times, would be found to vary.

Between the years 1884 and 1888, Dr. S. C. Chandler gathered together all the observations that had from time to time been made, and, after a careful analysis, was able to prove that these variations are accounted for by the fact that the earth does not rotate about its axis of figure, as above described, but about another axis, which he called the axis of rotation. This axis of rotation bisects the axis of figure at its center, and always preserves the same direction in space; but its poles slowly describe a circle about the poles of the axis of figure. From this consideration it is evident that the parallels of latitude do not preserve the same planes relative to space; but have an oscillatory motion. Hence the variation.

The motion is fairly well illustrated by a spinning top, whose center of gravity remains in the same vertical line, while the peg and the head describe two circles about this vertical line. The motion of any parallel lines on the top will roughly approximate to the motion of the lines of parallels of latitude on the earth's surface. The above illustration will only approximately show this motion of the earth, for the reason that the latter is complex, being made up of two superposed motions. The pole of rotation moves in a small circle which is itself moving around the pole of the earth's figure.

The period of the smaller circle is between 423 and 434 days; that of the larger between 361 and 369½ days.

The radius of the smaller circle is 14 feet. The center of the circle itself travels in an ellipse, the major axis of which is about 25 feet, and the minor about 8 feet.

A remarkable verification of Dr. Chandler's discovery was afforded by a series of tidal observations extending over 35 years, two of which were taken on the Pacific Coast and one on the Atlantic. These show a mean time of oscillation of the sea's level of 431 plus or minus 4 days, which agrees remarkably with the period of revolution as mentioned above. Newcomb had pointed out that if the theory of the revolution of the axis of rotation were true, low tide at any spot should occur when the pole of rotation lay nearest that spot—a suggestion with which the above tidal observations fully agree.

THE TEMPERATURE OF LAKES.

According to Desmond Fitz Gerald, M. Am. Soc. C. E., in a paper recently read at the annual convention of the society, the observation of the temperature of the water in lakes and reservoirs is attended with more difficulty than is generally supposed. Hitherto the taking of readings at any considerable depth has been rendered difficult and tedious on account of the unsuitability of the ordinary mercurial thermometer for such work. The invention of the thermaphone by Messrs. H. E. Warren and O. C. Whipple enables the observer to take in a few minutes a more accurate reading than was formerly possible after an hour's careful work.

The thermaphone is based upon the principle of the Wheatstone bridge, and it enables the temperature to be read at the surface of the water, the two metals which form the circuit being suspended at the desired depth. The two arms which complete the circuit at the surface are connected with a telephone which takes the place of the customary galvanometer. The theory of this very sensitive and accurate instrument is based upon the fact that different metals have different electrical temperature coefficients. A circular slide wire is connected to the two coils of dissimilar metal, which are lowered to the desired depth by means of two leading wires. This slide wire is wound around the edge of a disk, which carries a dial, graduated in degrees of temperature. A leading wire connected with the junction of the two metal coils connects with a telephone receiver and terminates in a radial contact arm, which travels upon the above mentioned disk. The ends of the slide wire are put in circuit with a battery. In reading the temperature, the radial contact arm is moved back and forth over the dial, and the telephone is held to the ear.

The buzzing sound in the telephone increases or decreases as the hand passes a certain point on the dial. By continually moving the hand, a point will be found at which the sound ceases altogether. The reading at this point indicates the temperature of the distant coil.

"This instrument is so accurate that its results can be depended upon to much less than 0·1° F., and a series of temperatures throughout the vertical can be taken with an allowance of about a minute for each point observed."

Surface Temperatures.—During the winter, from the latter part of December to the breaking up of the ice in the spring, the temperature of the water under the ice is 32° F. The water then warms at a uniform rate to 72° F. in the middle of June. From that time to the middle of August it varies between 73° and 78°, and then falls regularly to 37° in the middle of December.

Bottom Temperature.—In a pond less than 25 feet deep the bottom temperature varies very little from that at the surface. In the deeper lakes very interesting phenomena occur, which have an important bearing upon the question of domestic water supply. The observations were taken in connection with the Boston water works at Lake Cochituate.

The point of maximum density of fresh water is 39·2° F. This is about the temperature of the bottom of the lake when the surface freezes. "The several strata lie in their order of density, decreasing gradually until within a few feet of the surface, when they suddenly fall to the freezing point adjoining the ice." The body of water remains unchanged throughout the winter. At the breaking up of the ice, the surface water warms up to the temperature of the bottom layers; the whole body is thrown into "unstable equilibrium," and circulation takes place from top to bottom. As soon as the surface is 5° F. warmer than the bottom, circulation ceases. Although the temperature of the surface continues to rise, "the bottom remains at exactly the same temperature throughout the long period of stagnation," covering about seven months, during which time it varies only a few tenths of a degree. From this it is evident (1) that the agitation set up by the winds at the surface does not penetrate very deep (experience shows fifteen feet to be about the limit); (2) that there are no convectional currents at work to effect a change of temperature; and (3) that water is such a poor conductor of heat that the hottest sun's rays are not perceptible at the depth of sixty-five feet.

Weekly observations of temperature in Lake Cochituate for a period of four years show that the surface agitation by the wind keeps the water at an even temperature for the first ten feet of depth, and that below fifteen feet the effect is very slight.

The Effects of Stagnation.—The deeper, quiescent layers of water gather the organic matter from the waters above, and "decay goes on until the oxygen is used up." The water becomes dark in color and acquires a disagreeable smell.

Commenting upon these facts, Mr. F. P. Stearns