TEMPERATURE OF WATER AT VARIOUS DEPTHS IN LAKES AND OCEANS.

By Hamilton Smith, Jr., M. Am., Soc. C.E.

Mr. Smith at a meeting of the Am. So. of Civil Engineers expressed the opinion that the temperature of water drawn from a reservoir at a depth of 170 feet would be much more constant during the year than if drawn from a point say 60 feet below the surface. He stated that at one of the North Bloomfield reservoirs in California, formed by a masonry dam about 100 feet in height, the water was drawn from a point about 90 feet below the top of the dam. In July, when the temperature of the air is often above 90 degrees, the water near the surface is too warm for drinking, and not too cold for bathing, while the water from the deep point is almost icy cold. In the winter months, with a depth of 50 to 60 feet of water, that drawn from the bottom is from 5 to 7 degrees warmer than the stream water in the neighborhood; this fact being of great practical advantage, as the comparatively warm water enters the open canal of the Company and retains more or less of its high temperature for a distance of 15 miles, even during snow storms, while in other canals of that neighborhood, whose water comes from running streams, the flumes soon become choked by snow unless they are covered.

A number of observations upon the temperature of water were given. Those made by F. A. Forel, at the Lake of Geneva, Switzerland, showed a surface temperature varying from 41 degrees to 71 6-10 degrees, and a constant temperature of 41 4-10 degrees at the depth of 984 feet. The range at the depth of 164 feet was only from 43 3-10 to 44 8-10. This lake rarely freezes. Observations upon other Alpine lakes were given with the same general results. Prof. Wm. Ripley Nichols found the temperature of Fresh Pond at Cambridge, Mass., with a range of from 82½ degrees to 33½ degrees at a depth of 2 feet below the surface, while at a depth of 35 feet the variation was only from 51 degrees to 34½ degrees.

Prof. J. LeConte found the temperature of Lake Tabac, California, at 1506 feet below the surface to be 39 2-10 degrees, when at the surface it was 67 degrees. This lake has never been frozen across. In ocean soundings the *Challenger* found in latitude 37° 31' south, longitude 36° 37' west, a temperature of 30 9-10 degrees at a depth of 16,050 feet, and in several other soundings temperatures of 31 3-10 and 31 5-10. The *Blake* found north of St. Thomas, in the West Indies. 36½ degrees, at a depth of 27,366 feet, which is notable as being the deepest sounding thus far made. At this point the surface temperature practically remains constant at 80 degrees. The *Blake* soundings also show that in this heated current rapidly moving northward from the tropics there is a very rapid diminution of temperature, even at very small depths. The explanation of these low summer temperatures at considerable depths in bodies of fresh water is that water being most dense at about the temperature of 39 2-10 degrees, the surface water, which becomes cold in the winter, gradually sinks, and, water being a poor conductor, the strata, at depths of 200 feet or more, will retain during summer this lower temperature with but slight variations, although the surface may become heated up to 82 degrees, as at Fresh Pond, and perhaps even higher at other points. This theory does not seem to account for the very low temperature of 30 9-10 degrees recorded by the *Challenger*, or that of 36 2-10 degrees by the *Blake*. Possbly pressure may be a factor in this problem. There are great practical difficulties in determining accurately temperatures at such enormous depths. In the soundings near St. Thomas, the pressure of water amounts to near 12,000 pounds per square inch. Comparative tests, however, of the latest models of thermometer used by the United States Coast Survey, show satisfactory results. It is evident, therefore, that in a reservoir near this locality the surface temperature may reach 85 degrees in July and August, and go to 33 or 34 degrees in winter, while at a depth of 170 feet it will not vary greatly during the year from 45 degrees; this being on the assumption that the reservoir remains full. Where water can be obtained from depths of 60 to 170 feet. this consideration should have weight in determining the point from which it can be most advantageously drawn. On account of this lower temperature the water will probably be more free from organic matter or organisms. Of course, bottom temperature will become elevated as heated strata from near the surface find their way towards the bottom.

In the discussion of the paper, Mr. N. S. Keith described the construction and operation of the electrical apparatus used for ascertaining temperature at great depths. The paper was further discussed generally.

Miscellaneous Notes.

Gas Leakages.—An indicator of gas leakages has been constructed by Mons. C. V. Jhan, and is described in the *Revue Industrielle*. The apparatus consists of a vessel of porous earthenware, such as the porous cell of a galvanic battery, set upside down, and closed by a perforated india-rubber stopper. Through the hole in the stopper, the inside of the vessel is connected with a pressure gauge containing a little colored water. The vessel can be exposed to the air of an apartment where a leak of gas is suipected; or a sample of the air may be contained in a bell glass inverted over the porous cell. The diffusion of gas through the earthenware raises the level of the water in the pressure gauge, and when the latter is properly graduated and proportioned to the capacity of the cell axact and delicate indications may be obtained in a simple manner. This species of diffusiometer is so sensitive that when an Argand burner if gradually turned down until it is extinguished, the instrument, if held above the burner, will show a considerable rise of the water in four or five seconds. If held over an ordinary burner, turned on just sufficiently to be ignited, the liquid rises verw rapidly. When the instrument is graduated in millimetres a volume of one-half per cent. of gas in a room may be distinguished by it. An example is afforded by a case of sickness, wnich, in the opinion of the medical attendant, was due to gas poisoning. Some doubt arose on the point, because gas was not laid on to the house. The diffusiometer was brought into requisition, and showed the prhsence of gas, the source of which was afterward found in a broken main three metres distant from the house. A modification of the same instrument is made, whereby the sensitive portion is adapted for permanent exposure in any place difficult of access—such as the ceiling of a theatre or public building, where gas might be expected to collect, the indicating portion being fixed anywhere within view.

Consumption of Pig Iron in 1883.—From a comparison of the figures showing the production, imports, exports and stocks in hand, it appears that the consumption of pig iron for the year 1883 was 4,825,881 gross tons. It is a notable fact also, that, in spite of the general falling off of business, the figures of production and consumption of pig iron for the past three years show very little change. Thus, the consumption of 1881 waf 4,982,565 tons; that of 1882 was 4,956,171 tons; and that for 1883 was 4,825,881, a comparatively insignificant decline. The figures of production, imports and of stocks in hand, for the years 1883 and 1882, exhibit a remarkable uniformity, as will be observed from the following tabulation.

	1883. Gross tons.	1882. Gross tons.
Production	4,595,510	4,623,323
Importation	322,648	540,159
Makers' stocks, Jan. 1	383,655	188,300
Warehouse stocks, Jan. 1	14,356	9,953
Total	5,316,169	5,361,735

How Galvanized Iron is Made.—The iron to be covered is deprived of its coating of oxide by an acid bath composed of sulphuric acid and water, or of hydrochloric acid, in which it is immersed for a short time. It is then scrubbed with sand until the surface is cleansed; after which it is immersed in a concentrated solution of chloride of ammonium, taken out, and subsequently put into a bath of melted zinc, covered with fatty matter, or colophony, to prevent oxidatron, and stirred in it till the zinc forms an alloy at its surface. The coated metal is then, in some instances, introduced into a second bath consisting of melted tin, such as is used for tinning thin sheet-iron, when a slight coating of tin is formed on the exterior of the plate or bar. Of late years this second bath is generally dispensed with, a few pounds of tin being added to the zinc bath to produce the same effect.—*Mechanical Engineer.*

The Berryman Feed Water Heater.—Messrs. Wright & Co., of Tipton, Staffordshire, are erecting for a Manchester firm a number of Berryman feed water heaters of the largest