salinity etc.) by the turbulent movements from a definite unit volume in a definite direction and in an arbitrary unit of time, is given by the law of normal distribution (MAXWELL'S expression).

The coefficient of exchange through an area A, when z is vertical to A, can then be written:—

$$\eta = \frac{1}{2}\varrho \cdot \overline{z}^2 \tag{3}$$

which signifies in words half the product of the specific gravity and the "square of the standard deviation of the paths" referred to the unit of time used.

According to supposition 7), it should be possible for a water particle in motion to alter its velocity parallel to the area A without altering, for example, its salinity. Then the paths of a particle with unaltered qualities would be different for momentum parallel to the area A and for salinity. The momentum can be said to have a looser connection with the water than, for instance, the salt and can be partly transferred from sheet to sheet independently of the transfer of the water particles themselves.

Then, for momentum, a supposition analogous to 7) should be made, that:—

The frequency of the paths z for different uniform fractions of the momentum parallel to the area A, which is found in a certain volume and carried away by the turbulent movements in a direction perpendicular to A in an arbitrary unit of time, is given by the law of normal distribution.

Then the coefficient of exchange for momentum is also expressed by formula (3), with the special value of $\overline{z}^2$ referring to the momentum.

Besides the above-mentioned principles, the article discusses the exchange of energy and various other questions. The study of the coefficient of exchange is undoubtedly more advanced for the atmosphere than for the sea, but, even if it should not be possible to admit all the results obtained, it will undoubtedly be of great interest to study them by planning investigations at sea, which is the only way in which we are able to decide upon the reality of the theoretical deliberations leading to formula (1) or to formula (3).

J. P. JACOBSEN.

J. P. JACOBSEN. Eine graphische Methode zur Bestimmung des Vermischungskoeffizienten im Meere. Gerlands Beiträge zur Geophysik. Bd. XVI, Heft 4. Leipzig 1927.

In this paper Dr. JACOBSEN attacks a problem of great importance in hydrographical research, namely, how to obtain a measure of the extent to which, under oceanic conditions, intermixture takes place between superimposed, homogeneous water-masses possessing different physical characteristics. Incidentally it is claimed that the method expounded by the author has a wider application than the determination merely of a quantity termed "the mixing coefficient".

Being largely mathematical, the paper is appropriately opened with a short summary.

The graphical basis of the method which, theoretically, is founded upon the assumption that the laws relating to the diffusion of liquids are also applicable to the phenomenon of "mixing", is not new, being simply a curve drawn to the rectangular co-ordinates, temperature and salinity. Depths are marked on the curve itself at the appropriate points. A false observation is exposed by plotting the same along with the others belonging to the same station, provided always that observations are sufficiently numerous.

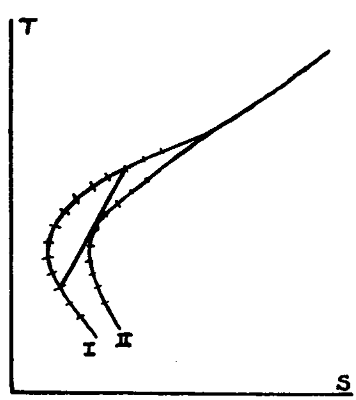
Such a curve, called a "T.S.-Diagram", representing the routine observations of a hydrographic station, may, in the absence of any current, afford information relative to the homogeneity or otherwise of the various water-layers, for, obviously, identical temperature and salinity readings, although pertaining to several depths, will be represented on the figure by a single point. A cluster of depth-marks on the curve, therefore, indicates homogeneity in the water-layers between the limiting depths of the group.

A portion of the curve for a particular station may be found to run, between two clusters of depth-marks, nearly in a straight line with depth-marks more or less well spaced along it. In the absence of current, intermixture between the two homogeneous water-masses is thus indicated and the degree of such at any of the intermediate depths for which observations are available is the ratio in which the depth-mark divides the specified portion of the curve.

The introduction to the co-ordinate diagram of the corresponding curves of equal density enables a qualitative estimate to be made concerning the vertical equilibrium at the station under examination.

Comparison of conditions at a number of stations, or at the same station at various times, may be effected by tracing the appropriate curves on transparent paper over the "key" sheet bearing the axes and curves of reference. By this means characteristically similar water-masses may be approximately defined in relation to their geographical orientation.

Two series of observations taken at the same station, but at different times, may be found to yield curves varying slightly between certain depths, as in the diagram, indicating vertical mixing between the depths in question. The "coefficient of mixing" is to be determined graphically



by drawing a tangent to the inner curve at the point of greatest curvature, thus cutting off an arc from the outer curve. The depth difference represented by this arc gives the value s in the formula:—

$$\mu t = \frac{1}{8} \cdot s^2$$

where μ is "the mixing coefficient" and t signifies time. J. B. T.

J. P. JACOBSEN. Contribution to the Hydrography of the North Atlantic. The "Dana"-Expedition 1921—22, with 25 Tables and 63 Figures in the Text. The Danish "Dana"-Expedition 1920—22 in the North Atlantic and the Gulf of Panama, Oceanographical Reports edited by the "Dana"-Committee. Nr. 3. Copenhagen—London 1929.

Auf der 1921—1922 unter der Leitung von JOHS. SCHMIDT ausgeführten "Dana"-Expedition in den Nordatlantik wurden ausser den biologischen Hauptaufgaben auch hydrographische Beobachtungen (t, S, O_2) ausgeführt und zwar von JOHS. OLSEN und N. C. ANDERSEN; die Bearbeitung des gesammelten Materials erfolgte durch J. P. JACOBSEN, die Beobachtungstabellen selbst sind kürzlich von JOHS. SCHMIDT in Nr. 1 der oben genannten Veröffentlichungsreihe mitgeteilt worden.

Zur Verschaffung eines hydrographischen Überblickes wurden die insgesamt 66 Stationen zu 10 Schnitten vereinigt und diese diskutiert. Vier Schnitte queren grössere Teile des offenen Ozeans und zwar von der Biscaya nach Haiti, von der Sargasso See nach Kap Norfolk, von der Strasse von Gibraltar nach den Kap Verden und von dort nach Cayenne. Auf ihnen tritt im Nordosten der Einfluss des Mittelmeerwassers und ausserhalb dessen Einflussbereiches der des antarktischen Zwischenstromes klar hervor. Die Tiefen unterhalb von 3000 m werden vom Wasser des nordatlantischen Tiefenstromes eingenommen, auf dem von den Kapverdischen Inseln nach Cayenne reichenden Schnitt ist dieser bereits durch den antarktischen Bodenstrom unterlagert. Die übrigen sechs Schnitte verlaufen im Bereiche des Antillen- und Florida-Stromes und zwar zwei im Caribischen Meere und im Atlantik parallel den Westindischen Inseln, die anderen zwischen Yukatan und Cuba, vom Florida Riff nach Cuba, von Florida nach der Bahama Bank und von San Salvador in Richtung nach dem Sargasso Meer, so dass hier wertvolles Material für ein genaueres Studium der Entwickelung des Golfstromes beschafft worden ist. Besonders bemerkenswert ist der Gegensatz in den hydrographischen Verhältnissen innerhalb und ausserhalb des westindischen Inselkranzes. Temperatur und Salzgehalt des Wassers im Caribischen Meere entspricht unterhalb von etwa 2000 m dem in etwa 1500 m Tiefe im benachbarten Ozean befindlichen Wasser, verändert nur durch die adiabatische Temperaturzunahme. Der Temperaturgegensatz dieser beiden Gebiete ist daher recht erheblich; z. B. wurde in 4000 m Tiefe südöstlich von Puertorico 4.22° und in geringem Abstand nördlich dieser Insel 2.44° festgestellt. Bemerkt sei, dass an dieser letzteren, am Rande des Puertoricograbens befindlichen Position zwischen 4000 und 5000 m adiabatische Temperaturzunahme von 2.44° auf 2.55° vorzuliegen scheint.