

lead weight attached to the line before it; and with repeated trials at full speed not the slightest difference could be detected.

The error of the Miller-pattern thermometer as deduced from the observations (some rejected in forming the mean), *abridged* :—

Error per 250 fathoms as shown by hydraulic press 0°161 mean
Deduct for calorific effect '018

True error for 250 fathoms 0°143
True error for 2,500 fathoms 1°43

Mean Errors of Hydrographic Office pattern Thermometers, by testing-apparatus, corrected for calorific effect :—

| Fathoms. | CASELLA. | PASTORELLI. |
|----------|----------|-------------|
| 250 | 1°307 | 1°482 |
| 500 | 2°789 | 2°664 |
| 750 | 3°821 | 4°279 |
| 1,000 | 4°853 | 5°195 |
| 1,250 | 5°860 | 6°743 |
| 1,500 | 7°392 | 7°623 |
| 1,750 | 8°199 | 9°307 |
| 2,000 | 9°638 | 10°106 |
| 2,250 | 10°838 | 11°438 |
| 2,500 | 12°270 | 12°520 |

The Progressive Rate of Error of the Hydrographic Office pattern Thermometers, as deduced from the foregoing table, by testing-apparatus, is by Casella, equal to an increase of effect at the rate of 0°'014 per 250 fathoms' pressure; and by Pastorelli, equal to a decrease of effect at the rate of 0°'044 per 250 fathoms' pressure.

Thus, while one set of thermometers show an increase of effect under pressure, the other set denote a decrease, and the mean of the two would be so small a decrease as not to be appreciable; and the practical conclusion is, that, by the testing-apparatus, the elasticity of the glass is in exact proportion to the pressure applied.

OCEAN OBSERVATIONS BY STAFF-COMMANDER E. K. CALVER

Although from the result of the experiments with the testing apparatus, a scale could be formed for the correction of the Hydrographic Office pattern thermometers, that scale may be said to be made under theoretical conditions rather than practical, and as it was necessary to verify its correctness by observations in the ocean, a number of the instruments used in the press were sent on board the *Porcupine* in 1869, and a series of most carefully taken observations were recorded by Staff-Commander Calver at the same depths as the calculated pressure applied in the press.

It is unnecessary to give the details of these observations; it will suffice to give the progressive error derived from the mean of them, and corrected for the error of the standard.

| Fathoms. | CASELLA. | PASTORELLI. |
|----------|----------|-------------|
| 250 | 1°329 | 1°210 |
| 500 | 2°816 | 2°086 |
| 750 | 4°002 | 4°779 |
| 1,000 | 5°427 | 6°422 |
| 1,250 | 6°286 | 7°065 |
| 1,500 | 7°058 | 8°118 |
| 1,750 | 7°301 | 8°301 |
| 2,000 | 7°711 | 8°844 |

The progressive rate of error derived from the above is by Casella, equal to a decrease at the rate of 0°'13 per 250 fathoms, and by Pastorelli, equal to a decrease of effect at the rate of 0°'09 per 250 fathoms.

This result, contrary to that by the hydraulic press, proves that the elasticity is not regular or in ratio to the

pressure, but that after continuing regular up to a pressure of 1,000 fathoms, it decreases in a compound ratio to a pressure of 2,000 fathoms, when its elasticity nearly ceases.

Comparison of the Hydrographic Office pattern Thermometers as found by the hydraulic testing-apparatus and by the Ocean Observations :—

CASELLA.

| Pressure. | Error. | | Per 250 fathoms. | |
|-------------------------------------|--------|--------|------------------|--------|
| | Press. | Ocean. | Press. | Ocean. |
| fms. | | | | |
| 250 | 1°307 | 1°329 | 1°307 | 1°329 |
| 500 | 2°789 | 2°816 | 1°394 | 1°408 |
| 750 | 3°821 | 4°002 | 1°274 | 1°334 |
| 1,000 | 4°853 | 5°427 | 1°213 | 1°357 |
| 1,250 | 5°860 | 6°286 | 1°172 | 1°257 |
| 1,500 | 7°392 | 7°058 | 1°232 | 1°176 |
| 1,750 | 8°199 | 7°301 | 1°171 | 1°043 |
| 2,000 | 9°638 | 7°711 | 1°205 | 0°964 |
| 2,250 | 10°838 | ... | 1°204 | ... |
| 2,500 | 12°270 | ... | 1°227 | ... |
| Means | | | 1°240 | 1°233 |
| Error at 2,500 fathoms by the means | | | 12'4 | 12'3 |

PASTORELLI.

| Pressure. | Error. | | Per 250 fathoms. | |
|-------------------------------------|--------|--------|------------------|--------|
| | Press. | Ocean. | Press. | Ocean. |
| fms. | | | | |
| 250 | 1°482 | 1°210 | 1°482 | 1°210 |
| 500 | 2°664 | 2°086 | 1°332 | 1°493 |
| 750 | 4°279 | 4°779 | 1°426 | 1°593 |
| 1,000 | 5°195 | 6°422 | 1°290 | 1°606 |
| 1,250 | 6°743 | 7°065 | 1°349 | 1°413 |
| 1,500 | 7°625 | 8°118 | 1°271 | 1°353 |
| 1,750 | 9°307 | 8°303 | 1°223 | 1°186 |
| 2,000 | 10°106 | 8°844 | 1°259 | 1°105 |
| 2,250 | 11°438 | ... | 1°271 | ... |
| 2,500 | 12°520 | ... | 1°252 | ... |
| Means | | | 1°327 | 1°370 |
| Error at 2,500 Fathoms by the means | | | 13'3 | 13'7 |

By this comparison, although the errors, as found by the two modes of observation, differ at individual depths or pressure, still the means of Casella's per 250 fathoms are almost the same, and those of Pastorelli's differ only three-tenths of a degree in 2,000 fathoms, the extent to which the comparison can be made.

There can be little doubt that, without the aid of the Miller pattern, by an extended series of observations a scale could have been obtained to correct the Hydrographic Office pattern to a very close approximation of the truth (in accordance with the proposed first intention of the experiments); but the timely suggestion of Dr. Miller has quite set at rest any difference of opinion as to the instrument for future use.

OYSTERS IN IRELAND*

HIS Excellency the Lord Lieutenant of Ireland having had represented to him that the artificial propagation of oysters was imperfectly understood in Ireland, appointed in October 1868 Messrs. Blake, M.P., Francis, Hart, and Brady, commissioners to inquire into and report on the artificial cultivation and propagation of oysters.

The instructions to the Commission were to visit the principal places in France, England, and Ireland, where oyster cultivation is or can be carried on, to examine the best authorities on the subject, and to ascertain as far as possible the causes which have led to failures. It was also hinted that three weeks would suffice for Ireland, a

* Report of the Commission appointed to inquire into the Methods of Oyster Culture in the United Kingdom and France, with a View to the Introduction of improved Methods of Cultivation of Oysters into Ireland. (Presented to both Houses of Parliament by command of Her Majesty.) Dublin, 1870.

fortnight for England, and the same amount of time for France. The Commission proceeded in October 1868 to France to commence their fortnight's tour, and in June 1870 presented their report, which has now been laid before Parliament. The Report occupies about fifty pages; and 150 more are very usefully taken up with a series of appendices. Ten plates are also included in the volume.

The Report commences with a list of the places visited by the Commission, from which we notice the omission of Dublin Bay, although Howth and Malahide had each at one time a respectable name for oysters. It then proceeds to give the natural history of the oyster, which we pass over without further comment than that it is a pity the Commissioners did not consult some person tolerably skilled in malacology ere they printed it—to criticise it would be but to break a butterfly on a wheel. The various branches of oyster fisheries are well described, and an interesting epitome is given of Coste's labours. It would appear that the great bulk of the oysters bred at Arcachon are sent to Marennes and Tremblade, where the green tint, so much esteemed in France, is imparted to the beard of the oyster. Such a prejudice exists in England against this green tint, that the Essex oysters are largely exported to France. It should be recollected that oysters impregnated with copper have always a greenish tinge of body, while those with green beards do not owe their colour to copper but to their peculiar feeding. The reporters suggest that the Diatomaceæ are probably the cause, and give figures of some Diatoms, to which we would call the attention of Dr. Donkin, who is writing a monograph of this group; to say the least, they are very comical.

The diminution in oyster production which has taken place in England, though very considerable, is not so great as in France. The Hayling Island enclosure is described, and plans of the beds given. The various methods of oyster culture are described, and appropriate places for their cultivation are pointed out. In reference to this portion of the subject, we may refer to the elaborate report on the temperature of the surface of the sea on the coasts of Great Britain, Ireland, and France, by Prof. Hennessy, in which he deduces that:

"1. The temperature of the sea on the coast of Ireland varies within narrower limits than on the coast of Great Britain, or, in other words, it is more equable throughout the year and also during the summer season, when oyster breeding takes place.

"2. The temperature of the sea at noon on the Irish coast, especially on the south and west coasts during the months of June and July, is, upon the whole, higher than on the coast of Great Britain, and less than on the west coast of France.

"3. This temperature seems to be sufficient for the requirements of oyster breeding, and therefore, *a fortiori*, the temperature about two in the afternoon under the conditions above referred to.

"4. The highest temperature of the seas surrounding Ireland, and probably also of those surrounding Great Britain, is during the month of August, and the least during the month of February.

"5. Any advantages as to temperature possessed by the seas which wash the Irish coast are unquestionably due to the thermal influence of currents connected with the Gulf Stream."

Prof. Sullivan also appends an important Report on the Composition of the Soils of Oyster Grounds, and on the qualities which exert most influence on oyster cultivation, and comes to the conclusions:—

"1. That the influence of the soil upon the breeding and growth of oysters is complicated by: temperature, especially during the spawning season; sudden alternations of heat and cold, due to currents; alternation of depth of water, especially as regards whether the maximum of sun-heat and

light concords with low water during the spawning season; velocity of tide, angle of inclination of shore, &c.

"2. That the soil of oyster grounds may be made up of materials of any of the great classes of rocks, arenaceous, argillaceous, or calcareous, provided they contain—

"3. More or less of a fine flocculent highly hydrated silt, rich in organic matter, which indicates that Diatomaceæ, Rhizopoda, Infusoria, and other minute creatures abound.

"4. That the character and abundance of such small organisms in a locality seems to be the true test of a successful oyster ground.

"5. And lastly, that although oysters do undoubtedly assimilate copper from water where mine-water containing traces of that metal flows into the sea in the neighbourhood of the oyster beds, the copper is chiefly, if not exclusively, confined to the body of the oyster, and does not appear to reach the mantle or beard. That the so-called green oysters of Essex, Marennes, and other places, on the other hand, are green-bearded and contain no copper, nor can the most minute trace of copper be detected in the soil of the oyster grounds where such green-bearded oysters are produced."

The Report concludes with the following recommendations:—

"1. That all regulations with regard to the close time around the Irish coast should be strictly maintained.

"2. That the inspectors of Irish fisheries should have power, whenever they determine to reserve a bank or any portion thereof from public dredging for the purpose of recovery, to make such arrangements as may seem desirable for keeping the restricted part free from weeds and vermin.

"3. That there should be procurable at each coastguard station, at a small cost, general information as to oyster culture, and simple instructions as to the best modes of proceeding.

"4. That the inspectors be empowered to adopt such other means as they may deem necessary to afford information and instruction to those requiring it with respect to oyster culture.

"5. That having unsizable oysters in possession in places where it is prohibited by any bye-law to take oysters from any public beds under a certain size, shall be *prima facie* evidence that such oysters were taken in places so prohibited; such regulations not to apply to private oyster grounds.

"6. That facilities be afforded to the coast population to acquire the use of small portions of foreshore, or sea bottom, for oyster cultivation, and to obtain loans on satisfactory security for the preparation of same, and for the purchase of oysters, collectors, &c.

"7. That landed proprietors desirous of cultivating oysters on the shores adjoining their lands, be empowered to avail themselves of the provisions of the Irish Land Improvement Acts, for the purpose of oyster cultivation."

We would commend the perusal of this Report to those interested in this subject; of its importance there can be little doubt; and while we agree with the commissioners that no very extraordinary profits are to be made out of oyster culture, and that hence it is not a subject for extensive commercial speculation, yet we know of none more deserving of the attention of those interested in the general welfare of this country.

E. P. W.

ARTIFICIAL MILK

AMONG the many sorrowful records of the Siege of Paris, one of the most enduring, and not the least touching in its melancholy eloquence, is afforded by the