The Temperature Correction of Barometers. By R. T. OMOND.*

In correcting the reading of a barometer to the freezing-point, it is customary to ascertain the temperature of the instrument by observing a thermometer attached to the brass frame, but it is doubtful how far this attached thermometer indicates the temperature of all parts of the barometer under the conditions in which most observations are made. In a Fortin barometer the level of the mercury in the cistern is adjusted to a fixed point at each observation, and we have only to consider the expansion with heat of the mercury and of the brass scale. As the expansion of mercury is about ten times that of brass, the former is the chief factor in the problem, and a simple piece of apparatus was constructed to show how far the attached thermometer differed from the temperature of the mercury. A brass tube, such as forms the casing of an ordinary standard barometer, was taken, and inside this a glass tube of the same diameter and thickness as is generally used was placed. The glass tube was closed at the lower end, and filled with mercury to near the top, in which a cork was inserted; passing through this cork was a thermometer whose bulb dipped into the mercury, and whose scale could be read through the glass tube and the slots in the upper part of the brass tube, where the scale is in a finished barometer. This thermometer, therefore, gave directly the temperature of the upper part of the mercury column; and as mercury is a good conductor of heat, this was assumed to be the temperature of the whole column for the purposes of the experiment. Another thermometer was attached outside the brass scale in the usual manner, and the experiments consisted in comparing the readings of the two thermometers under varying temperature conditions.

For sudden changes of temperature a very simple law was found to govern the relationship of the two thermometers. When the instrument is taken from a warm room to a cold, or *vice versa*, the outer thermometer alters most rapidly; it takes about an hour for the two to come into agreement again for differences between the rooms ranging from 7° to 20° ; the maximum difference between the two thermometers occurs about ten minutes after the change is made, and this difference amounts to 40 per cent. of the whole change of temperature. For example: on 23rd December 1899, at 5 P.M. the two thermometers read $44^{\circ}\cdot 1$ and $44^{\circ}\cdot 0$; the instrument was then moved into a warmer room; at 5.11 P.M. the readings were $52^{\circ}\cdot 2$ and $48^{\circ}\cdot 0$ —a difference of $4^{\circ}\cdot 2$, the outside attached thermometer being the higher, and this was the greatest difference observed. The difference between them decreased till at 5.47 P.M. they read $54^{\circ}\cdot 9$ and $54^{\circ}\cdot 7$, showing a total change of $10^{\circ}\cdot 8$,—($44^{\circ}\cdot 1$ to $54^{\circ}\cdot 9$). Similarly, for a change of

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7°·2, the greatest observed difference was 2°·8 at ten minutes after the change of place ; and for a change of 19°·9, the greatest difference was 8°·1 at eleven minutes.

Every degree Fahr. above the freezing-point corresponds to not quite 0·003 inch of expansion in the mercury column of a barometer, so that a reading taken at 5.11 P.M. under the conditions of the first experiment would introduce an error of fully 0·010 into the barometric pressure.

Further experiments were made to ascertain the effect of opening the window of a warm room, and lighting a fire in a cold room. It was found that in either case differences of 2° or 3° between the two thermometers could be caused, which would give rise to errors of nearly a hundredth of an inch. The latter case is especially interesting. There must be many instances of the 9 A.M. reading of a barometer being taken in a room in which a fire has been recently lit, and these ought therefore to show the 9 A.M. reading during winter lower relatively than in summer when fires are not used.

These experiments indicate that to get a satisfactory reading of barometers as at present constructed, it is necessary that during the hour previous they should not be exposed to a change of temperature of more than 3°. If this condition be fulfilled, the temperature of the mercury will approximate so closely to that of the attached thermometer, as not to introduce an error greater than the unavoidable errors in setting and reading the instrument.