adjusting thermometers to a ſcale, and to one another, are the boiling and freezing water points. The boiling water point, it is well known, is not an invariable point, but va­ries ſome degrees according to the weight and temperature of the atmoſphere. In an exhauſted receiver, water will boil with a heat of 98⁰ or 100⁰ ; whereas in Papin's digester it will acquire a heat of 412. Hence it appears that water will boil at a lower point, according to its height in the atmoſphere, or to the weight of the column of air which presses upon it. In order to enſure uniformity therefore in the conſtruction of thermometers, it is now agreed that the bulb of the tube be plunged in the water when it boils vio­lently, the barometer ſtanding at 30 Engliſh inches (which is its mean height round London), and the temperature of the atmoſphere 55⁰*.* A thermometer made in this way, with its boiling point at 212⁰, is called by Dr Horſley *Bird's Fah­renheit,* becase Mr Bird was the firſt perſon who attended to the ſtate of the barometer in conſtructing thermometers.

As artiſts may be often obliged to adjuſt thermometers under very different pressures of the atmoſphere, philoſophers have been at pains to discover a general rule which might be applied on all occaſions. Μ. de Luc, in his *Recherches sur les Mod. de l’Atmoſphere* from a ſeries of experiments, has given an equation for the allowance on account of this difference, in Paris measure, which has been verified by Sir George Schuckburgh@@\*; alſo Dr Horſley, Dr Maſkelyne, and Sir George Schuckburgh, have adapted the equation and rules to Engliſh meaſures, and have reduced the allow­ances into tables for the uſe of the artiſt. Dr Horſley’s rule, deduced from De Luc’s, is this :

99/8990000log. z — 92.804 = h.

where *h* denotes the height of a thermometer plunged in boiling water, above the point of melting ice, in degrees of Bird’s Fahrenheit, and z the height of the barometer in 10ths of an inch. From this rule he has computed the fol­lowing table, for finding the heights, to which a good Bird’s Fahrenheit will rise when plunged in boiling water, in all states of the barometer, from 27 to 31 Engliſh inches; which will ſerve, among other uſes, to direct inſtrument-makers in making a true allowance for the effect of the va­riation of the barometer, if they ſhould be obliged to finiſh a thermometer at a time when the barometer is above or below 30 inches ; though it is beſt to fix the boiling point when the barometer is at that height.

|  |  |  |
| --- | --- | --- |
| *Equation of the Boiling Point.* | | |
| Barometer. | Equation. | Difference. |
| 31.0 | + 1.57 | 0.78 |
| 30.5 | + 0.79 | 0.78 |
| 30.0 | 0.00 | *0.79* |
| 29.5 | — 0.80 | 0.80 |
| 29.0 | — *1.62* |  |
| 28.5 | — 2.45 | 0.83 |
| 28.0 | — 3.31 | 0.85 |
| 27.5 | — 4.16 | 0.86  0.88 |
| 27.0 | ~ 5∙04 |  |

The numbers in the firſt column of this table express heights of the quickſilver in the barometer in Engliſh inches and decimal parts : the ſecond column ſhows the equation to be applied, according to the ſign **prefixed,** to **212⁰ of** Bird’s Fahrenheit, to find the true boiling point for every ſuch ſtate of the barometer. The boiling point for all in­termediate states of the barometer may be had with ſufficient accuracy, by taking proportional parts, by means of the

third column of differences of the equations. See *Phil. Trans.* lxiv. art. 30. ; alſo Dr Maſkelyne’s *Paper,* vol. lxiv. art. **20.**

In the following table we have the reſult of 15 different observations made by Sir George Schuckburgh compared with the reſult of Μ. de Luc’s rules.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Height of the Barometer reduced to the same temperature of 50⁰. | Mean boil­ing Point by Obſervation. | Boiling Point by De Luc's Rules. | Height of Barometer. | Boiling  Point by Obſervation. | Boiling Point by De Luc’s Rules. |
| Inch. | 0 | 0 | Inch. | 0 | 0 |
| 26,498 | 207,07 | 208,54 | 30,008 | 213,22 | 213,47 |
| 27,241 | 208,64 | 208,84 | 30,207 | 213,58 | 213,79 |
| 27,954 | 209,87 | 210,03 | 30,489 | 214,15 | 214,23 |
| 28,377 | 210,50 | 210,81 | 30,763 | 214,37 | 214,66 |
| 28,699 | 211,27 | 211,34 | 30,847 | 214,83 | 214,79 |
| 28,898 | 211,50 | 211,67 | 30,957 | 214,96 | 214,96 |
| 28,999 | 211,60 | 211,85 |  |  |  |
| 29,447 | 212,55 | 212,74 |  |  |  |
| 29,805 | 212,95 | 213,15 |  |  |  |

Sir George Schuckburgh has alſo ſubjoined the following general table for the uſe of artiſts in conſtructing the ther­mometer, both according to his own obſervations and thoſe of Μ. de Luc.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Height of the Barometer. | Correct of the boiling point | Difference | Correct. accord. to Μ. de Luc. | Difference. |
|  | 0 |  | 0 |  |
| 26,0 | — 7,09 |  | — 6,83 |  |
| 26,5 | — 6,18 | ,91 | — 5,93 | ,90 |
| 27,0 | — 5,27 | ,91 | — 5,04 | ,89 |
| 27,5 | — 4,37 | ,90 | — 4,16 | ,88 |
| **28,0** | — 3,48 | **,89** | — 3,31 | ,87 |
| 28,5 | — 2,59 | ,89 | — 2,45 | ,86 |
| 29,O | — 1,72 | **,87** | — 1,62 | ,83 |
| 29,5 | — 0,85 | ,87 | — 0,80 | ,82 |
| 30,0 | 0,00 | **,85** | 0,00 | ,80 |
| 30,5 | + 0,85 | ,85 | + 0,79 | ,79 |
| 31,0 | + 1,69 | ,84 | + 1,57 | ,78 |

The Royal Society, fully apprized of the importance of adjuſting the fixed points of thermometers, appointed a committee of ſeven gentlemen to conſider of the beſt me­thod for this purpoſe ; and their report is publiſhed in the Phil. Tranſ. vol. lxvii. part ii. art. 37.

They obſerved, that though the boiling point be placed ſo much higher on ſome of the thermometers now made than on others, yet this does not produce any conſiderable error in the obſervations of the weather, at leaſt in this climate; for an error of 1⁰1/2 in the position of the boiling point, will make an error only of half a degree in the position of 92⁰, and of not more than a quarter of a degree in the point of 62⁰. It is only in nice experiments, or in trying the heat of hot liquors, that this error in the boiling point can be of much importance.

In adjuſting the freezing as well as the boiling point, the quickſilver in the tube ought to be kept of the same heat **as** that in the ball. When the freezing point is placed at **a** conſiderable diſtance from the ball, the pounded ice ſhould be piled to ſuch a height above the ball, that the error which can ariſe from the quickſilver in the remaining part of the tube not being heated equally with that in the ball, ſhall be very ſmall, or the obſerved point must be corrected on that account according to the following table :

@@@[m]\* Phil. Trans. For 1775 and 1778.