moirs of the Academy of Sciences. This thermometer was made with ſpirit of wine. He took a large ball and tube, the dimensions and capacities of which were known ; he then graduated the tube, ſo that the ſpace from one diviſion to another might contain 1000th part of the liquor; the li­quor containing 1000 parts when it stood at the freezing point. He adjusted the thermometer to the freezing point by an artificial congelation of water : then putting the ball of his thermometer and part of the tube into boiling water, he obſerved whether it roſe 80 diviſions : if it exceeded theſe, he changed his liquor, and by adding water lowered it, till upon trial it ſhould just riſe 80 diviſions ; or if the liquor, being too low, fell ſhort of 80 diviſions, he raiſed it by add­ing rectified ſpirit to it. The liquor thus prepared ſuited his purpoſe, and ſerved for making a thermometer of any size, whoſe ſcale would agree with his standard.

This thermometer was far from being perfect. As the bulbs were three or four inches in diameter, the ſurrounding ice would be melted before its temperature could be propagated to the whole ſpirits in the bulb, and conſequently the freezing point would be marked higher than it ſhould be. Dr Martine accordingly found, that inſtead of coinci­ding with the 32d degree of Fahrenheit, it correſponded with the 34th, or a point a little above it. Reaumur commit­ted a miſtake alſo reſpecting the boiling point ; for he thought that the ſpirit of wine, whether weak or ſtrong, when immerged in boiling water, received the same degree of heat with the boiling water. But it is well known that highly rectified ſpirit of wine cannot be heated much be­yond the 175th degree of Fahrenheit, while boiling water raiſes the quickſilver 37 degrees higher. There is another thermometer that goes by the name of *Reaumur's,* which ſhall be afterwards deſcribed.

At length a different fluid was propoſed, by which ther­mometers could be made free from moſt of the detects hi­therto mentioned. This fluid was mercury, and ſeems firſt to have occurred to Dr Halley in the laſt century ; but was not adopted by him on account of its having a ſmaller degree of expanſibility than the other fluids uſed at that time @@\*. Boerhaave ſays that the mercurial thermometer was firſt conſtructed by Olaus Roemer ; but the honour of this invention is generally given to Fahrenheit of Amſterdam, who preſented an account of it to the Royal Society of London in 1724.

That we may judge the more accurately of the propriety of employing mercury, we will compare its qualities with thoſe of the fluids already mentioned, air, alcohol, and oil.

Air is the moſt expansible fluid, but it does not receive nor part with its heat ſo quickly as mercury. Alcohol does not expand much by heat. In its ordinary ſtate it does not bear a much greater heat than 175⁰ of Fahrenheit ; but when highly rectified it can bear a greater degree of cold than any other liquor hitherto employed as a meaſure of temperature. At Hudſon's Bay, Mr Macnab, by a mix­ture of vitriolic acid and ſnow, made it to deſcend to 69 be­low 0 of Fahrenheit. There is an inconvenience, however, attending the use of this liquor ; it is not poſſible to get it always of the ſame degree of ſtrength. As to oil, its expanſion is about 15 times greater than that of alcohol ; it ſuſtains a heat of 6000, and its freezing point is ſo low that it has not been determined ; but its viſcoſity renders it uſeleſs.

Mercury is far ſuperior to alcohol and oil, and is much more manageable than air. 1. As far as the experiments already made can determine, it is of all the fluids hitherto employed in the conſtruction of thermometers, that which meaſures moſt exactly equal differences of heat by equal differences of its bulk : its dilatations are in fact very nearly proportional to the augmentations of heat applied to it @@(a). 2. Of all liquids it is the moſt eaſily freed from air. 3. It is fitted to meaſure high degrees of heat and cold. It ſuſtains a heat of 600⁰ of Fahrenheit’s ſcale, and does not congeal till it fall 39 or 40 degrees below 0. 4. It is the moſt ſenſible of any fluid to heat and cold, even air not excepted. @@\*Sir Benja­min Thompſon, now Count Rumford, found that mercury was heated from the freezing to the boiling point in 58 seconds, while water took two minutes 13 seconds, and com­mon air 10 minutes and 17 ſeconds. 5. Mercury is a ho­mogeneous fluid, and every portion of it is equally dilated or contracted by equal variations of heat. Any one ther­mometer made of pure mercury is, *caeteris paribus,* poſſeſſed of the same properties with every other thermometer made of pure mercury. Its power of expanſion is indeed about six times leſs than that of ſpirit of wine, but it is great enough to anſwer moſt of the purpoſes for which a thermo­meter is wanted.

The fixed points which are now univerſally choſen for

@@@[m]\* Phil. Trans. vol. xvii. or Abr. vol. ii.

@@@[m]\* Phil. Trans. for 1786.

@@@(a) We have affirmed that the expanſions of the bulk of quickſilver by heat are nearly (for they are not ſtrictly ſo) in a regular arithmetical progreſſion, according to the quantity of heat it is expoſed to ; and ſuch ſeems to be the case according to the Table publiſhed by Mr de Luc, at page 309. of his firſt volume on the Modifications of the Atmoſphere. The following extract of this table ſhows theſe variations : and the firſt and ſecond differences are added, in order to render theſe irregularities more ſenſible. They are ſuch as can hardly be conceived from the nature of any ſubſtance, without the influence of extraneous and accidental cauſes, which may have eſcaped the attention of the obſerver ; neither have they been found exactly true by Dr Crawford. Mr de Luc ſupposes the whole heat from melting ice to that of boiling water to be divided into 80 parts ; by the fractional subdiviſions of which he expresses the abſolute quan­tities of heat, anſwering to each 5, or 10 degrees of Reaumur’s thermometer (= 22,5 of Fahrenheit’s ſcale) ; ſo that the whole ſum of theſe fractions amounts exactly to the assumed number 80. They are as follow :

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Reaumur's Thermometer | Fahrenheit's Thermometer | Quantities of heat. | First differences. | Second differences. |
|
| Degrees | 80 | 212 |  |  |  |
|  | 70 | 189,5 | 9,44 | '16 |  |
|  | 60 | 167 | 9,60 | '10 | + ,06 |
|  | 50 | 144,5 | 9,70 | '16 | — ,06 |
|  | 40 | 122 | 9,86 | '22 | — ,06 |
|  | 30 | 99,5 | 10,08 | '12 | +,10 |
|  | 20 | 77 | 10,20 | '18 | — ,06 |
|  | 10 | 54,5 | 10,38 | '56 | — ,18 |
|  | 0 | 32 | 10,74 |  |  |