nected at one end with a large glaſs ball A, and at the other end immerſed in an open vesſel, or terminating in a ball DE, with a narrow orifice at D ; which veſſel, or ball, contains any coloured liquor that will not eaſily freeze. Aquafortis tinged of a fine blue colour with a ſolution of vi­triol or copper, or ſpirit of wine tinged with cochineal, will answer this purpoſe. But the ball A muſt be first mode­rately warmed, so that a part of the air contained in it may be expelled through the orifice D; and then the liquor pressed by the weight of the atmoſphere will enter the ball DE, and rise, for example, to the middle of the tube at C, at a mean temperature of the weather; and in this ſtate the liquor by its weight, and the air included in the ball A, &c. by its elaſticity, will counterbalance the weight of the atmoſphere. As the ſurrounding air becomes warmer, the air in the ball and upper part of the tube, expanding by heat, will drive the liquor into the lower ball, and conſequently its ſurface will deſcend ; on the contrary, as the ambient air becomes colder, that in the ball is condenſed, and the liquor pressed by the weight of the atmoſphere will ascend : ſo that the liquor in the tube will aſcend or deſcend more or leſs according to the ſtate of the air contiguous to the inſtrument. To the tube is affixed a ſcale of the ſame length, divided upwards and downwards from the middle C into l00 equal parts, by means of which the aſcent and deſcent of the liquor in the tube, and conſequently the va­riations in the cold or heat of the atmoſphere, may be obſerved.

This inſtrument was extremely defective ; for the air in the tube was not only affected by the heat and cold of the atmolphere, but alſo by its weight.

The air being found improper for meaſuring with accu­racy the variations of heat and cold according to the form of the thermometer which was first adopted, another fluid was propoſed about the middle of the 17th century by the Florentine academy. This fluid was ſpirit of wine, or al­cohol, as it is now generally named. The alcohol being coloured, was incloſed in a very fine cylindrical glaſs tube previouſly exhauſted of its air, having a hollow ball at one end A, and hermetically ſealed at the other end D. The ball and tube are filled with rectified ſpirit of wine to a convenient height, as to C, when the weather is of a mean temperature, which may be done by inverting the tube into a vessel of ſtagnant coloured ſpirit, under a receiver of the air pump, or in any other way. When the thermometer is properly filled, the end D is heated red hot by a lamp, and then hermetically ſealed, leaving the included air of about ⅓of its natural denſity, to prevent the air which is in the ſpirit from dividing it in its expanſion. To the tube is applied a ſcale, divided from the middle, into 100 equal parts, up­wards and downwards.

As ſpirit of wine is capable of a very conſiderable degree of rarefaction and condenſation by heat and cold, when the heat of the atmoſphere increaſes the ſpirit dilates, and con­ſequently riſes in the tube ; and when the heat decreaſes, the ſpirit descends, and the degree or quantity of the motion is ſhown by a ſcale.

The ſpirit of wine thermometer was not ſubject to ſome of the inconveniences which attended the air thermometer. In particular, it was not affected by variations in the weight of the atmoſphere : accordingly it ſoon came into general uſe among philoſophers, It was, at an early period, intro­duced into Britain by Mr Boyle. To this inſtrument, as then uſed, there are, however, many objections@@.The li­quor was of different degrees of ſtrength, and therefore dif­ferent tubes filled with it, when expoſed to the ſame degree of heat, would not correſpond. There was alſo another defect: The scale which was adjuſted to the thermometer did not commence at any fixed point, The higheſt term was ad­juſted to the great ſunſhine heats of Florence, which are too variable and undetermined; and frequently the work­man formed the ſcale according to his own fancy. While the thermometer laboured under ſuch diſadvantages it could not be of general uſe

To obtain ſome fixed unalterable point by which a deter­mined ſcale might be discovered, to which all thermometers might be accurately adjuſted, was the ſubject which next drew the attention of philoſophers. Mr Boyle, who ſeems at an early period to have ſtudied this ſubject with much anxiety, propoſed the freezing of the essential oil of anniseeds as a convenient point for graduating thermometers ; but this opinion he ſoon laid aſide. Dr Halley next propoſed that thermometers should be graduated in a deep pit under ground, where the temperature both in winter and ſummer is pretty uniform ; and that the point to which the ſpirit of wine should rise in ſuch a ſubterraneous place ſhould be the point from which the ſcale ſhould commence. But this propoſal was evidently attended with ſuch inconveniences that it was soon abandoned. He made experiments on the boil­ing point of water, of mercury, and of ſpirit of wine ; and he ſeems rather to give a preference to the ſpirit of wine@@\*. He objected to the freezing of water as a fixed point, be­cauſe he thought that it admitted conſiderable latitude.

It ſeems to have been reſerved to the all-conquering ge­nius of Sir Isaac Newton to determine this important point, on which the accuracy and value of the thermometer de­pends. He choſe, as fixed, those points at which water freezes and boils ; the very points which the experiments of ſucceeding philoſophers have determined to be the moſt fix­ed and convenient. Senſible of the diſadvantages of ſpirit of wine, he tried another liquor which was homogeneous enough, capable of a conſiderable rarefaction, about 15 times greater than ſpirit of wine. This was linseed oil. It has not been obſerved to freeze even in very great colds, and it bears a heat about four times that of water before it boils. With theſe advantages it was made uſe of by Sir Iſaac Newton, who diſcovered by it the comparative de­gree of heat for boiling water, melting wax, boiling ſpirit of wine, and melting tin ; beyond which it does not appear that this thermometer was applied. The method he uſed for adjuſting the ſcale of this oil thermometer was as fol­lows : Suppoſing the bulb, when immerged in thawing ſnow, to contain 10,000 parts, he found the oil expand by the heat of the human body ſo as to take up 1/39th more ſpace, or 10,256 ſuch parts ; and by the heat of water boil­ing ſtrongly 10,725 ; and by the heat of melting tin 11,516. So that reckoning the freezing point as a common limit be­tween heat and cold, he began his ſcale there, marking it o, and the heat of the human body he made 12⁰ ; and conſe­quently, the degrees of heat being proportional to the de­grees of rarefaction, or 256 :725 : : 12 : 34, this number 34 will express the heat of boiling water ; and by the ſame rule, 72 that of melting tin @@\*. This thermometer was conſtructed in 1701\*.

To the application of oil as a meaſure of heat and cold, there are inluperable objections. It is ſo viſcid, that it ad­heres too ſtrongly to the ſides of the tube. On this ac­count it aſcends and descends too ſlowly in caſe of a ſudden heat or cold. In a ſudden cold, ſo great a portion remains adhering to the ſides of the tube after the reſt has ſubſided, that the ſurface appears lower than the corresponding tem­perature of the air requires. An oil thermometer is there­fore not a proper meaſure of heat and cold.

All the thermometers hitherto propoſed were liable to many inconveniences, and could not be considered as exact ſtandards for pointing out the various degrees of tempera­ture. This led Reaumur to attempt a new one, an ac­count of which was publiſhed in the year 1730 in the Me-

@@@[mu]\* Martine's Essays.

@@@[m]\* Phil. Trans. Abr. II. 34.

@@@[m]\* Phil. Trans. n⁰ 270. or Abr. vol. iv. part 2.