isting condition of the other branches of contemporaneous science ; and in taking for granted the accuracy of the existing state of knowledge, he proceeded to raise a theoretical structure on ground not yet sufficiently ascertained and determined. The result has been, as might have been anticipated, that now, when the progress of accurate knowledge has altered the conditions on which his system was based, his theory, becoming inapplicable to the facts, has been thrown aside, and, instead of having been modi fied, as it ought to have been, in conformity with the ad vancement of science, it has been hastily abandoned or undeservedly neglected.

From an extensive and laborious review of all that has since been added to the stores of our experimental facts on the properties of vapour, we have been conducted to this conclusion, that of all the views that have been taken of the constitution and laws of vapour, Dr Dalton’s are those from which we may gain the clearest and most adequate conceptions ; and therefore we have undertaken the task of reviewing the subject, and of making those changes and modifications which are now required to represent with fidelity and precision the advanced state of our know ledge.

If we examine any series of even the earlier experiments on the vapour of water (such as those in Art. 27), we cannot fail to recognise a certain d2gree of regularity in the progress of the increasing force of the vapour as the temperature is successively augmented. At the temperature of freezing water, the force of its vapour being taken at two-tenths of an inch, we see that it becomes more than *doubled* by raising the temperature 221/2°: this again is rather more than *doubled* at 22½o of additional heat ; and this is again exactly *doubled* by a third addition of 22½°. But another addition of 22½° of heat scarcely doubles the pressure ; and 22½° more fall still further short of producing that effect ; so that, while the increase of the force of the steam takes place rapidly, with equal additions of heat, the rapidity of the increase does not maintain a constant proportion, but slowly diminishes as the temperature ascends. This will be plainer in the following table

|  |  |  |  |
| --- | --- | --- | --- |
| Temperature of the Vapour. | Pressure on Mercury. | Proportion of Increase. | Decrease of Proportion. |
| 32° | 0∙200 |  | 8 |
| 54½ | 0∙445 | 2 + 17/100 |  |
| 77 | 0∙910 | 2 + 9/100 |  |
| 99½ | 1∙820 | 2+ 0/0 | 9∙ |
| 122 | 3∙500 | 2 — 8/100 | 8∙ |
| 144½ | 6∙450 | 2 — 16/100 | 8∙ |
| 167 | 11∙250 | 2—25/100 | 9∙ |
| 189½ | 18∙800 | 2—23/100 | 8∙ |
| 212 | 30000 | 2—41/100 | 8∙ |

From this simple collocation of results, a principle of progression is manifested. The number of degrees in the first column increases at each step by 22½ degrees, and the number in the second column on the same line is nearly doubled every step. At first, as the third column shows, it is more than doubled by 17/100 next time it is more than doubled by 9/100, and next it is doubled exactly ; after this, however, it falls 8/100 short of being doubled, next time by twice that quantity, and so on, till we find at last that it falls short of doubling every time by about 8 or 9 hundredths for every 11½ degrees. Although, therefore, we may at first be disappointed in finding that the reduplication does not proceed with the regularity of a law of na ture, still it is satisfactory to know that the deviation from this progression is itself the subject of a tolerably simple law, so as to enable us to predict, with some measure of

accuracy, what would take place if we were to add another increment of 221/2 degrees. We should then diminish the number in the third column by 9/100, and by doubling the pressure, and having regard to this diminution from the preceding numbers, 2—41/100 we should have at

234½° 45.00 2.—50/200 —9

And again at

257 63.90 2.——8

It was in this way that Dr Dalton examined his experiments, and proceeded to form his tables, so as to include not only those points which he had already examined by experiment, but to fill up the vacancies, and extend them beyond the range which his actual observation had reach ed. He thus completed the table which we have already given. This was much more accurate than any previous table, and, being more extensive, formed a valuable addition to our knowledge.

This simple method of interpolation by which Dr Dalton constructed his table, although it suited perfectly, the limited object which he at that time had in view, and coincided with the limited range of his observations, was not of a sufficiently general description to stretch far beyond that sphere. It is obvious, that if his progression were continued much further, it would come to an end of itself ; because the constant diminution of the proportion in the third column would bring it down to nothing, and so the march of the method would close and retrograde, and would thus bring the method of the formation into opposition with the march of the fact, for the force of the vapour continues to increase. Dr Dalton was himself the first to recognise the limited applicability of his method of interpolation to wide ranges of temperature ; and, accordingly, in his lectures on heat, delivered at Edinburgh and Glasgow in 1807, and in his *New System of Chemistry,* published 1808, he developed those larger and more ma­tured views which had grown up in his mind during a longer and more thorough investigation of the subject.

It does not belong to this article to consider the nature, and decide on the merits of Dr Dalton’s theory of temperature ; nor is a perfect acquaintance with that theory of any further use in understanding his views of the constitution of vapour, than to enable us to perceive how he was led from the former to the latter. For the validity of his views regarding steam, it is indeed of no consequence whether the theory of temperature from which it was originally deduced, be true or erroneous. The general laws which he has determined for elastic vapours, form the well-settled foundation on which any theory of temperature, true or false, must in some measure ultimately rest.

The only circumstances in regard to temperature which it is proper to keep in view, are these : that the present thermometer used to indicate temperature is not to be regarded as an exact measure of the *quantity* of heat producing that temperature. This is shown from the circumstance, that the same quantity of fuel which heats water 10° from 180° to 190°, will not heat it from 80° to 90°, an equal interval. From considerations of this nature it was evident that the divisions of the common scale were too large near the bottom, and too small in the higher portions ; and Dr Dalton evinced this difference to be so great, that 72° of the common scale below the freezing point of water down to the freezing point of mercury, were to be reckoned as equivalent to as many as 207° of Dalton’s scale. Proceeding on this view, it was necessary to find the ratio of these two series of indications, the indications of Dalton’s and of Fahrenheit’s scale ; and he accordingly found that the progression of Fahrenheit’s scale was in a high geometrical proportion to the increments of true temperature of the new one. On this principle he proceeded to construct his new scale of temperature—of which the following is a specimen.