We formerly obſerved, that the ſeries of mixtures choſen by Sir Charles Blagden, for the advantages at­tending it in making the experiment, was not ſuited for ſolving the questions which commonly occur in the spirit buſineſs. He accordingly ſuggeſts the propriety of forming tables in a convenient series from the data furniſhed by theſe experiments, indicating the proportion of ingredients contained in ſome conſtant weight or bulk.

To facilitate the conſtruction of ſuch tables, it is neceſſary to conſider the ſubject in the moſt general manner. Therefore let *a* repreſent the confiant num­ber 100. Let w and *s* repreſent the quantities of water and ſpirit by weight in any mixture ; that is, the pounds, ounces, or grains of each; Let *x* repreſent the quantity *percent,* of ſpirits alſo by weight ; that is, the number of pounds of ſpirits contained in 100 pounds of the mixture ; and let *y* be its quantity *percent,* in gallons, or the number of gallons contained in 100 gallons of the unmixed ingredients. Let *m* be the bulk of a pound of ſpirit of any given temperature, the bulk of a pound of water *of the ſame temperature* being accounted 1.

Then w+s is the weight of any mixture, and w+*m s* is its bulk.

We have the following proportions : I. w+ s: s = a : x, and x = as/w+s (Equation 1ſt); and hence s may be found when *x* the percentage in weight is given, for s + wx/a-x (Equation 2.)

2. w + ms : ms = a : y, and y = a ms/w+ms (Equation 3d) ; and s may be found when y, the percentage in gallons, is given ; for s = my/a-y (Equation 4th.)

The uſual queſtions which can be ſolved from theſe experiments are,

I. To ascertain the quantity of ſpirits *per cent,* in bulk from obſervation of the specific gravity, or to tell how many gallons of ſpirit are in 100 gallons of mix­ture.

Look for the specific gravity in the table, and at the head of the column will be found the w and *s* correſponding. If the preciſe specific gravity obſerved is not in the tables, the s muſt be found by interpola­tion. And here it is proper to remark, that taking the ſimple proportional parts of specific gravity will not be sufficiently exact, eſpecially near the beginning or the end of the table, becauſe the denſities correſponding to the ſeries of mixtures do not change uniformly. We muſt have recourſe to the general rules of interpolation, by means of firſt and second differences, or be provided with a ſubsidiary table of differences. A good deal of practice in computations of this kind ſuggeſted the fol­lowing method of making ſuch interpolations with great diſpatch and abundant accuracy. On a plate of wood, or metal, or ſtiff card-paper, draw a line EF (fig. 3.),. as a ſcale of equal parts, repreſenting the leading or equable arithmetical ſeries of any table. (In the preſent caſe EF is the ſcale on which *s* is computed.)— Through every point of diviſion draw the perpendicu­lars BA, EC, F D, &c. Make one of them AB more conſpicuous than the rest, and diſtinguiſh the others alſo in ſuch sort, that the eye ſhall readily catch their diſtance from the principal line A B. Let GPL be a thin flip of whalebone, of uniform breadth and thickneſs, alſo divided into equal parts properly diſtinguiſhable. Laſtly, let there be a pin P fixed near the mid­dle of the principal line AB.

Now ſuppoſe that a value of s is to be interpolated by means of an obſerved specific gravity not in the ta­ble. Look for the neareſt to it, and note its diſtance from the preceding and the following. Let theſe be PH and PK on the flexible ſcale. Alſo take notice of the lines K 10 and H 10, whoſe diſtances from AB are equal to the conſtant difference between the ſucceſsive values of S, or to any eaſily eſtimated multiple of it (as in the preſent caſe we have taken 10 and 10, inſtead of 5 and 5, the running difference of Sir Charles Blagden’s table). Then, leaning the middle point P of the whalebone on the pin P in the board, bend it, and place it ſlantwiſe till the points K and H fall ſomewhere on the two parallels K 10 and H 10. No matter how oblique the poſition of the whalebone is. It will bend in ſuch a manner that its different points of divi­sion (repreſenting different specific gravities) will fall on the parallels which repreſent the correſponding va­lues of *s.* We can ſay that all this may be done in leſs than half a minute, and leſs time than is neceſſary for inſpecting a table of proportional parts, and not the tenth part of that neceſſary for interpolating by ſecond differences. Yet it is exact enough (if of the size of a duodecimo page ) for interpolating three decimal places, This is ten times more exact than the preſent caſe re­quires. To return from this digreſſion.

Having thus found *s* in the table, we get *x* or y by the equations as/w+s = x, and a ms/w+ms = y.

But here a material circumſtance occurs. The weight of alcohol *s,* and its percentage *x,* was rightly deter­mined by the specific gravity, becauſe it was interpolated between two values, which were experimentally con­nected with this specific gravity. But in making the tranſition from *x* to *y,* we only give the per centage in gallons before mixture, but not the number of gal­lons of alcohol contained in an hundred gallons of mix­ed liquor. For when we have taken *a—y* and y inſtead of w and *s,* they will indeed make a ſimilar compound when mixed, becauſe the proportion of their ingredients is the ſame. But they will not make 100 gallons of this compound, becauſe there is a ſhrinking or condenſation by mixture, and the specific gravity by which we interpolated *s* is the physical or real specific gravity correſponding to *w* and *s* ; while w+s/w x ms, the specific gravity implied in the value of *y,* is the mathematical denſity independent on this condenſation. Since there­fore y, together with *a—y,* make leſs than 100 gal­lons of the compound, there muſt in 100 gallons of it be more alcohol than is expreſſed by *y.*

Let G be the mathematical specific gravity (= w+s/w+ms), and *g* the physical or real obſerved specific gravity (which we cannot expreſs algebraically) ; .and let *z* be the gallons of alcohol really contained in 100 gallons of the compound. The bulk being inverſely as the denſity or specific gravity, it is evident that the.