accompliſhments, however, could not ſave her from the fury of the fanatics of Alexandria, who cut her in pieces for having taken an offenſive part in a diſ­pute between the governor and patriarch.—We have deſcribed ſome of the moſt approved of theſe inſtru­ments in the article Hydrometer, and ſhall in this place make a few obſervations on the principles of their conſtruction, not as they are uſually made, accommodated to the examination of particular liquors, but as indica­tors of pure ſpecific gravity. And we muſt premiſe, that this would, for many reaſons, be the beſt way of conſtructing them. The very ingenious contrivances for accommodating them to particular purpoſes are un­avoidably attended with many ſources of error, both in their adjuſtment by the maker and in their uſe ; and all that is gained by a very expenſive inſtrument is the saving the trouble of inſpecting a table. A ſimple ſcale of ſpecific gravity would expoſe to no error in conſtruction, becauſe all the weights but one, or all the points of the ſcale but one, are to be obtained by cal­culation, which is incomparably more exact than any manual operation, and the table can always be more exact than any complex obſervation. But a ſtill greater advantage is, that the inſtruments would by this means be fitted for examining all liquors whatever, whereas at preſent they are almoſt uſeleſs for any but the one for which they are conſtructed.

Hydrometers are of two kinds. The moſt ſimple and the moſt delicate are just a ſubſtitute for the hydroſtatical balance.@@ They conſiſt of a ball (or rather an egg or pear-ſhaped veſſel, which moves more eaſily through the fluid) A (fig. I.) having a foot pro­jecting down from it, terminated by another ball B, and a ſlender ſtalk or wire above, carrying a little diſh **C.** The whole is made ſo light as to float in the lighteſt fluid we are acquainted with ; ſuch as vitriolic or muriatic æther, whoſe ſpecific gravity is only 0,73. This number ſhould be marked on the diſh, indicating that this is the ſpecific gravity of the fluid in which the inſtrument floats, sinking to the point D of the stem. The ball B is made heavy, and the foot is of ſome length, that the inſtrument may have liability, and ſwim erect, even if conſiderably loaded above ; and, for the ſame reaſon, it muſt be made very round, otherwiſe it will lean to a ſide. When put into a heavier liquor, its buoyancy will cauſe it to float with a part of the ball above the ſurface. Weights are now put into the ſcale C, till the inſtrument sink to D. The weight put into the ſcale, added to the weight of the inſtrument, is the weight of the diſplaced fluid. This, compared with the weight of the whole when the instrument is ſwimming in pure water, gives the ſpeciſic gravity of the fluid. All trouble of calculation may be avoided by marking the weights with ſuch num­bers as ſhall indicate the ſpecific gravity at once. Thus having loaded the inſtrument to as to sink it to D in pure water, call the whole weight 1000 ; then weigh the inſtrument itſelf, and ſay, “ as the weight when ſwimming in water is to its preſent weight, ſo is

1000 to a 4th proportional.” This is the ſpeciſic gra­vity of the liquor which would float the unloaded inſtrument. Suppoſe this to be 730. The hydrome­ter would juſt float in muriatic æther, and this ſhould he marked on the ſide. Now make a ſet of ſmall

weights, and mark them, not by their weights in grains, but in ſuch units that 270 of them ſhall be equal to the weight which fits the inſtrument for pure water.

Suppoſe that, in order to float this inſtrument in a certain brandy, there are required 186 in theſe ſmall weights. This added to 730 gives 916 for the ſpeciſic gravity, and ſhows it to be preciſely exciſe proof ſpi­rit. Nine weights, viz, 256, 128, 64, 32, 16, 8, 4, 2, 1, will ſuffice for all liquors from æther to the ſtrongeſt worts. And that the trouble in changing the weights may be greatly leſſened, let a few circles *a, b, c, d, e,* be marked on the top of the ball. When we ſee it float unloaded at the circle C for instance, we know it will require at leaſt 128 to sink it to D thaton the ſtem.

If the weights to be added above are conſiderable, it raiſes the centre of gravity ſo much, that a ſmall want of equilibrium, by laying the weights on one ſide, will produce a great inclination of the inſtrument, which is unſightly. Inſtead therefore of making them looſe weights, it is proper to make them round plates, with a ſmall hole in the middle, to go on a pin in the middle of the ſcale. This will keep the inſtrument always up­right. But unleſs the hydrometer is of a conſiderable ſize, it can hardly be made ſo as to extend from the lighteſt to the heavieſt fluid which we may have oc­caſion to examine, even though we except mercury. Some of the mineral acids are conſiderably more than twice the weight of æther. When there is ſuch a load at top, the hydrometer is very apt to overſet, and inclines with the ſmallest want of equilibrium. Great ſize is inconvenient even to the philoſopher, becauſe it is not always in his power to operate on a quantity of fluid sufficient to float the inſtrument. Therefore two, or perhaps three, are neceſſary for general examina­tion. One may reach from æther to water ; another may ſerve for all liquors of a ſpeciſic gravity between 1 and 14 ; and the third, for the mineral acids, may reach from this to 2. If each of theſe be about two ſolid inches in capacity, we may eaſily and expeditiouſly de­termine the ſpeciſic gravity within one ten thouſandth part of the truth : and this is preciſion enough for moſt purpoſes of ſcience or busineſs.

The chief queſtions are, 1. To aſcertain the ſpeciſic gravity of an unknown fluid. This needs no farther explanation. 2. To aſcertain the proportion of two fluids which are known to be in a mixture. This is done by diſcovering the ſpeciſic gravity of the mixture by means of the hydrometer, and then deducing the proportion from a compariſon of this with the ſpecific gravities of the ingredients.

In this mode of examination the bulk is always the ſame ; for the hydrometer is immerged in the diffe­rent fluids to the ſame depth. Now if an inch, for example, of this bulk is made up of the heavieſt fluid, there is an inch wanting of the lighteſt ; and the change made in the weight of the mixture is the difference between the weight of an inch of the hea­vieſt and of an inch of the lighteſt ingredients. The number of inches therefore of the heavieſt fluid is proportional to the addition made to the weight of the mixture. Therefore let B and *b* be the bulks of the heavieſt and lighteſt fluids in the bulk of the mixture ; and let D, *d,* and ϧ be the denſities, or the weights, or the ſpecific gravities (for they are in one

@@@[mu] Plate CCCLXXII.