Or = *a(xx/AB2)*

Preſ. on B by the whole wt. on AC = 1/2AC2/AB2 = a(AC2/2AB2).

Strain at C by the weight on AC *= a(AC2* × BC)/(2AB2)*.*

Strain at C by the weight on BC *= a(BC2* × AC)/(2AB2).Do. by the whole weight on AB = a(AC2 × BC + BC2 × AC)/(2AB2), = a(AC × BC × AC + CB)/ (2AB2), = (AC × BC)/2AB.

Thus we ſee that the ſtrain is proportional to the rec­tangle of the parts, in the ſame manner as if the load *a* had been laid directly on the point C, and is indeed equal to one-half of the ſtrain which would be produced at C by the load *a* laid on there.

It was necessary to be thus particular, becauſe we ſee in ſome elementary treatiſes of mechanics, publiſhed by au­thors of reputation, miſtakes which are very plauſible, and miſlead the learner. It is there ſaid, that the pressure at B from a weight uniformly diffuſed along AB is the ſame as if it were collected at its centre of gravity, which would be the middle of AB ; and then the ſtrain at C is ſaid to be this preſſure at B multiplied by BC. But ſurely it is not difficult to ſee the difference of theſe ſtrains. It is plain that the pressure of gravity downwards on any point be­tween the end A and the point C has no tendency to diminiſh the ſtrain at C, arising from the upward reaction of the prop B ; whereas the pressure of gravity between C and B is almoſt in direct opposition to it, and muſt diminiſh it. We may however avoid the fluxionary calculus with ſafety by the conſideration of the centre of gravity, by ſuppoſing the weights of AC and BC to be collected at their reſpective centres of gravity ; and the reſult of this computation will be the ſame as above : and we may uſe either method, al­though the weight is not uniformly diſtributed, provided only that we know in what manner it is diſtributed.

This inveſtigation is evidently of importance in the prac­tice of the engineer and architect, informing them what ſupport is necessary in the different parts of their conſtructions. We conſidered ſome caſes of this kind in the article Roofs.

It is now eaſy to form a joiſt, ſo that it ſhall have the ſame relative ſtrength in all its parts.

I. To make it equally able in all its parts to carry a given weight laid on any point C taken at random, or uniformly diffuſed over the whole length, the ſtrength of the ſection at the point C muſt be as AC × CB. Therefore

1. If the ſides are parallel vertical planes, the ſquare of the depth (which is the only variable dimension) or CD2, muſt be as AC × CB, and the depths muſt be ordinates of an ellipſe.

2. If the tranſverſe ſections are ſimilar, we muſt make CD3 as AC × CB.

3. If the upper and under ſurfaces are parallel, the breadth muſt be as AC × CB.

II. If the beam is neceſſarily loaded at ſome given point C, and we would have the beam equally able in all its parts to refill the ſtrain arising from the weight at C, we muſt make the ſtrength of every tranſverſe ſection between C and either end as its diſtance from that end. Therefore

1. If the ſides are parallel vertical planes, we muſt make CD2 : EF2 = AC : AE.

2. If the ſections are ſimilar, then CD3 : EF2 = AC : AE.

3. If the upper and under surfaces are parallel, then, breadth at C ; breadth at E = AC : AE.

The ſame principles enable us to determine the ſtrain and ſtrength of ſquare or circular plates, of different extent, but equal thickness. This may be comprehended in this general propoſition.

Similar plates of equal thickneſs ſupported all round will carry the ſame abſolute weight, uniformly diſtributed, or reſting on ſimilar points, whatever is their extent.

Suppoſe two ſimilar oblong plates of equal thickneſs, and let their lengths and breadths be L, l, and B, *b.* Let their ſtrength or momentum of coheſion be C, *c,* and the strains from the weights W, w, be S, s.

Suppoſe the plates ſupported at the ends only, and reſiſting fracture tranſverſely. The ſtrains, being as the weights and lengths, are as WL and w*l,* but their cohe­ſion are as the breadths ; and ſince they are of equal rela­tive ſtrength, we have WL : wl = B : *b,* and WLb = *wl*B and L : *l = w*B : W*b* : but ſince they are of ſimilar ſhapes L : l = B : *b,* and therefore w = W.

The ſame reaſoning holds again when they are alſo ſup­ported along the ſides, and therefore holds when they are ſupported all round (in which caſe the ſtrength is doubled).

And if the plates are of any other figure, ſuch as circles or ellipſes, we need only conceive ſimilar rectangles inſcribed in them. Theſe are ſupported all round by the con­tinuity of the plates, and therefore will ſuſtain equal weights ; and the ſame may be ſaid of the ſegments which lie without them, becauſe the ſtrengths of any ſimilar ſeg­ments are equal, their lengths being as their breadths.

Therefore the thickneſs of the bottoms of vessels holding heavy liquors or grains ſhould be as their diameters, and as the ſquare root of their depths jointly.

Alſo the weight which a ſquare plate will bear is to that which a bar of the ſame matter and thickneſs will bear as twice the length of the bar to its breadth.

There is yet another modification of the ſtrain which tends to break a body tranſverſely, which is of very fre­quent occurrence, and in some caſes muſt be very care­fully attended to, viz. the ſtrain arising from its own weight.

When a beam projects from a wall, every ſection is ſtrained by the weight of all that projects beyond it. This may be conſidered as all collected at its centre of gravity. Therefore the ſtrain on any ſection is in the joint ratio of the weight of what projects beyond it, and the diſtance of its centre of gravity from the ſection.

The determination of this ſtrain and of the ſtrength ne­cessary for withſtanding it muſt be more complicated than the former, becauſe the form of the piece which reſults from this adjuſtment of ſtrain and ſtrength influences the ſtrain. The general principle muſt evidently be, that the ſtrength or momentum of coheſion of every ſection muſt be as the product of the weight beyond it multiplied by the diſtance of its centre of gravity. For example :

Suppoſe the beam DLA (fig. 18.) to project from the wall, and that its ſides are parallel vertical planes, ſo that the depth is the only variable dimenſion. Let LB = x and B*b = y.* The element B*bc*C is *— yx.* Let G be the centre of gra­vity of the part lying without B *b,* and gbe its diſtance from the extremity L. Then *x—g* is the arm of the lever by which the ſtrain is excited in the ſection B*b.* Let B*b* or *y* be as ſome power m of LB ; that is, let y = xm. Then the contents of LB*b* is (xm + I)/(m + I). The momentum of gravi­ty round a horizontal axis at L *is yxx = xm + 1x,* and the whole momentum round the axis is (*xm + 2)/(m + 2)*. The diſtance of