By comparing Experiments 1ſt and 3d, the ſtrength ap­pears proportional to the breadth.

Experiments 3d and 4th ſhew the ſtrength proportional to the ſquare of the depth.

Experiments 1ſt and 5th ſhew the ſtrength nearly in the inverſe proportion of the lengths, but with a ſenſible de­ficiency in the longer pieces.

Experiments 5th and 7th ſhew the ſtrengths proportional to the breadths and the ſquare of the depth.

Experiments 1ſt and 7th ſhew the ſame thing, compound­ed with the inverſe proportion of the length : the deficiency relative to the length is not ſo remarkable here.

Experiments 1st and 2d and experiments 5th and 6th ſhew the increaſe of ſtrength, by fattening the ends, to be in the proportion of 2 to 3. The theory gives the propor­tion of 2 to 4. But a difference in the manner of fixing may produce this deviation from the theory, which only ſuppoſed them to be held down at places beyond the props, as when a joiſt is held in the walls, and also reſts on two pillars between the walls. ( See what is ſaid on this ſubject in the article Roof, 19.) ; where note, that there is a miſtake, when it is ſaid that a beam ſupported at both ends and loaded in the middle will carry twice as much as if one end were fixed in the wall and the weight ſuſpended at the other end. The reaſoning employed there ſhows that it will carry four times as much.

The chief ſource of irregularity in ſuch experiments is the fibrous, or rather plated texture of timber. It conſiſts of annual additions, whoſe coheſion with each other is vaſtly weaker than that of their own fibres. Let fig. 21. repreſent the ſection of a tree, and ABCD, *abcd* the ſection of two battens that are to be cut out of it for experiment, and let AD and *a d* be the depths, and DC, *d c* the breadths. The batten A BCD will be the ſtrongest, for the ſame reaſon that an aſſemblage of planks ſet edgewise will form a ſtronger joiſt than planks laid above each other like the plates of a coach-ſpring. Mr Buffon found by many trials that the ſtrength of ABCD was to that of *abcd* (in oak) nearly as 8 to 7. The authors of the different experiments were not careful that their battens had their plates all diſpoſed ſimilarly with reſpect to the ſtrain.· But even with this precaution they would not have afforded sure grounds of computation for large works ; for great beams occupy much, if not the whole, of the ſection of the tree ; and from this it has happened that their ſtrength is leſs than in proportion to that of a ſmall lath or batten. In ſhort, we can truſt no experiments but ſuch as have been made on large beams. Theſe muſt be very rare, for they are moſt expenſive and laborious, and exceed the abilities of moſt of thoſe who are diſpoſed to ſtudy this matter.

But we are not wholly without ſuch authority. Mr Buf­fon and Mr Du Hamel, two of the firſt philoſophers and me­chanicians of the age, were directed by government to make experiments on this ſubject, and were ſupplied with ample funds and apparatus. The relation of their experiments is to be found in the Memoirs of the French Academy for 1740, 1741, 1742, 1768; as alſo in Du Hamel’s valuable performances s*ur l'Exploitation des Arbres, et ſur la Conſervation et le Tranſport de Bois.* We earneſtly recommend theſe diſſertations to the peruſal of our readers, as containing much uſeful information relative to the ſtrength of timber, and the beſt methods of employing it. We ſhall here givean abſtract of Mr Buffon’s experiments.

He relates a great number which he had proſecuted during two years on ſmall battens. He found that the odds of a single layer, or part of a layer, more or leſs, or even a different diſpoſition of them, had ſuch influence that he was obliged to abandon this method, and to have recourſe to thelargeſt beams that he was able to break. The following table exhibits one ſeries of experiments on bars of ſound-oak, clear of knots, and four inches ſquare. This is a ſpecimen of all the rest.

Column 1ſt is the length of the bar in feet clear between the ſupports.

Column 2d is the weight of the bar (the 2d day after it was felled) in pounds. Two bars were tried of each length. Each of the firſt three pairs conſiſted of two cuts of the ſame tree. The one next the root was always found the heavieſt, ſtiffeſt, and ſtrongeſt. Indeed Mr Buffon ſays that this was invariably true, that the heavieſt was always the ſtrongeſt ; and he recommends it as a certain (or ſure) rule for the choice of timber. He finds that this is always the caſe when the timber has grown vigorouſly, forming very thick annual layers. But he also obſerves that this is only during the advances of the tree to maturity ; for the ſtrength of the different circles approaches gradually to equality during the tree’s healthy growth, and then it de­cays in theſe parts in a contrary order. Our tool-makers assert the ſame thing with reſpect to beech : yet a contrary opinion is very prevalent ; and wood with a fine, that is, a ſmall grain, is frequently preferred. Perhaps no person has ever made the trial with ſuch minuteneſs as Mr Buf­fon, and we think that much deference is due to his opinion.

Column 3d is the number of pounds neceſſary for breaking the tree in the courſe of a few minutes.

Column 4th is the inches which it bent down before breaking.

Column 5th is the time at which it broke.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **1** | ***2*** | 3 | 4 | 5 |
| 7 | 60 | 5350 | 3,5 | 29' |
| 56 | 5275 | 4,5 | 22 |
| 8 | 68 | 4600 | 3,75 | 15 |
| 63 | 4500 | 4,7 | 13 |
| 9 | 77 | 4100 | 4,85 | 14 |
| 71 | 3950 | 5,5 | 12 |
| 10 | 84 | 3625 | 5,83 | ***15*** |
| 82 | 3600 | 6,5 | 15 |
| 12 | 100 | 3050 | 7, |  |
| 98 | 2925 | 8, |  |

The experiments on other ſizes were made in the same way. A pair at leaſt of each length and size was taken. The mean reſults are contained in the following table. The beams were all ſquare, and their ſizes in inches are placed at the head of the columns, and their lengths in feet are in the firſt column.