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

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

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

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

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

Experiments 1st and 2d, and experiments 5th and 6th, show the increase of strength, by fastening the ends, to be in the proportion of two to three. The theory gives the pro­portion of two to four. 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.

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. 19 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 *ad* be the depths, and DC, *dc* the breadths. The batten ABCD will be the stronger, 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. Μ. Buffon found by many trials that the strength of ABCD was to that of *abcd* (in oak) nearly as eight to seven. 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 subject.

But we are not wholly without such authority. Μ. Buf­fon and Μ. Duhamel, 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 Duhamel’s valuable performances *Sur 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 give an abstract of Μ. Buffon's experi­ments.

He relates a great number which, during two years, he had prosecuted 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 the largest 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 clear feet between the supports.

Column 2d is the weight of the bar (the second 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 Μ. 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 Μ. 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 number of inches which it bent down before breaking.

Column 5th is the time at which it broke.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 |
|  | 60 | 5350 | 3∙5 | 29 |
| 7 | 56 | 5275 | 4∙5 | 22 |
|  | 68 | 4600 | 3∙75 | 15 |
|  | 63 | 4500 | 4∙7 | 13 |
| 9 | 77 | 4100 | 4∙85 | 14 |
|  | 71 | 3950 | 0∙5 | 12 |
|  | 84 | 3625 | 5∙83 | 15 |
|  | 82 | 3600 | 6∙5 | 15 |
| 10 | 100 | 3050 | 7∙ | ... |
| 12 | 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.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 4 | 5 | 6 | 7 | 8 | A |
| 7 | 5312 | 11525 | 18950 | 32200 | 47649 | 11525 |
| 8 | 4550 | 9787 | 15525 | 26050 | 39750 | 10085 |
| 9 | 4025 | 8308 | 13150 | 22350 | 32800 | 8964 |
| 10 | 3612 | 7125 | 11250 | 19475 | 27750 | 8068 |
| 12 | 2987 | 6075 | 9100 | 16175 | 23450 | 6723 |
| 14 |  | 5300 | 7475 | 13225 | 19775 | 5763 |
| 16 |  | 4350 | 6362 | 11000 | 16375 | 5042 |
| 18 |  | 3700 | 5562 | 9245 | 13200 | 4482 |
| 20 |  | 3225 | 4950 | 8375 | 11487 | 4034 |
| 22 |  | 2975 | ... | ... | ... | 3667 |
| 24 |  | 2162 |  | ... | ... | 3362 |
| 28 |  | 1775 | ... | ... | ... | 2881 |

Μ. Buffon had found, by numerous trials, that oak-timber lost much of its strength in the course of drying or season-