

by a mortice or pin-hole, two cleavages must be made from the hole to the end in order to force the part out, consequently, the distance from the hole to the end, need be only five times the width of the hole ; i. e., an inch hole should be 5 inches, and a two inch hole, 10 inches from the end.

Timber is sometimes liable to be crushed by forces acting transversely to its fibres. If the pressure be applied to the whole side of a piece, the pressure should not exceed 150, or at most 200 lbs. to the square inch, in practice. If the pressure act on one-half or less of the surface, it will bear from 300 to 500 lbs. to the inch without yielding so as to endanger the work. Hard timbers will bear from 20 to 50 per cent. more.

From what has been said, it follows that for a piece to act to the best advantage by tension, if the connection be made all at the same point in the length, the piece must be cut half off, so as to form an area of shoulder equal to the cross section of the remaining part of the stick. But if several shoulders be made, a less number of the fibres will require to be separated.

If, on a piece 4 inches thick, instead of a shoulder of 2 inches, at 20 inches from the end, we make two of 1 inch each, one at 10 and the other at 20 inches from the end, we have the same area of shoulder, and fifty per cent. more fibres to act by tension, which may be made available by cutting another shoulder at 30 inches from the end. Thus a greater portion of the fibers, but a less portion of the length is made available.

In the same manner, if a piece be connected by pinning, requiring two pins of 2 inches diameter, at 10 inches from the end, four 1 inch pins, two at 5 and two at 10 inches, (if stiff enough,) will give the same shoulder surface, and require the cutting of only half as many fibres ; and two more pins, at 15 inches from the end, will give three-fourths of the whole amount of fibres available. In case the smaller pins are not stiff enough, they may be of an oblong section in the direction of the strain.