ciently stiff, the pin may yield somewhat without injury to its strength. The transverse strength of pin timber may be taken at about 300 lbs. to the inch. The formula \(4 \times 300 ad \div l\) (\(a\) = cross section, and \(d\) = diameter of pin,) gives the amount that the pin will bear in the middle.—Now \(l\), in this case, is equal to \(1\frac{1}{2}\) the thickness \((t)\) of the middle piece of timber, and the effect of the force exerted by said middle piece, is two-thirds of what the same force would produce if concentrated in the middle of the pin. We have, then, \(4 \times 1\frac{1}{2} \times 300 ad \div 1\frac{1}{2}t = 1200 ad \div t\) = strength of the pin.

But the opposed surface will bear 1000td.

Putting this expression equal to the former, and deduc-
ing the value of \(d\), in terms of \(t\), it will shew the smallest diameter of a wooden pin strong enough to bear as much as the opposed surface.

This gives \(d\) a trifle (about 2\(\frac{1}{3}\) per cent,) larger than \(t\).

In the same manner, \(4 \times 1\frac{1}{2} \times 5000 ad \div 1\frac{1}{2}t\), represents the strength of an iron pin in the same circumstances; and putting this equal to 1000td gives the most economical diameter of an iron pin = \(1\frac{2}{3}t\), and the length = 2t.

Since the pieces \(a\) and \(c\), [Fig. 28,] require each half the thickness of the piece \(b\), and since the diameter of the pin should be about \(\frac{1}{4}t\), it will be equal to \(\frac{1}{4}\) the thickness of \(a\) or \(c\). Hence, when a piece is fastened on by spiking, the spike should have a diameter equal to \(\frac{1}{2}\), and a length from 3 to 4 times the thickness of the piece spiked on, in order to secure the greatest effect, for the amount of material cut off by the spike hole.

When the end bearings of the pin act transversly to the grain, they require at least 50 per cent more extent of bearing, which increases the value of \(l\) in the formula to \(1\frac{3}{4}t\), and the effect of the force upon the middle portion to \(\frac{1}{4}\) of the effect of the same force acting all at the centre. The equation for the proper diameter of the pin, then, will be \(4 \times 1\frac{3}{4} \times 5000 ad \div 1\frac{3}{4}t = 1000td\), whence \(d = 2\frac{83}{12}t\), and the length, \(2\frac{1}{2}t\).