sion: consequently d may be taken at $0.8d_1$ as a matter of convenience.

To find the proportion between width and depth of bars for the smallest allowable pin in an iron bridge, —

Let the notation be as before, and first let us suppose that there be but one pair of bars acting at each end of the pin, and that the total tension be a fixed quantity. The stress in one bar is wd_1T, and its moment is w^2d_1T. This must be equal to the resisting-moment of the pin, which is given by the well-known equation

$$M = \frac{RI}{D}.$$

Here $R = \frac{3}{2}T$, $I = \frac{1}{4}\pi r^4$, and $D = r = \frac{d}{2}$, substituting which gives

$$M = \tfrac{3}{64}\pi Td^3.$$

Equating the two values of the moments gives

$$w^2dT_1 = \tfrac{3}{64}\pi Td^3,$$

or

$$w^2 = \frac{3\pi}{64} \cdot \frac{d^3}{d_1}.$$

Now, to make the diameter of the pin as small as possible, the moment of the stress must be made as small as possible; and, as the stress is constant, the lever-arm w must be made as small as possible. But the product of w and d_1 is a constant: so when w is smallest, d_1 must be greatest. But the greatest value of d_1 is $\frac{5}{4}d$; substituting which gives

$$w^2 = \frac{3\pi}{64} \times \frac{64}{125} d_1^2 = 0.754 d_1^2,$$

and

$$w = 0.274 d_1,$$

or about one-fourth of the depth of the bars.

If there be two pairs of similar bars acting at each end of the pin, instead of one pair, the equation of moments will be

$$2w^2d_1T = \tfrac{3}{64}\pi Td^3,$$