Note. The *mean* diameter of the cask may be found by adding 2 thirds, or, if the staves be but a little curving, 6 tenths, of the difference between the head and bung diameters, to the head diameter. The cask will then be reduced to a cylinder.

Now, if the square of the mean diameter be multiplied by '7854, (ex. 177) the product will be the area of one end, and that, multiplied by the length, in inches, will give the solid content, in cubic inches, (ex. 185,) which, divided by 231, (note to table, wine meas.) will give the content in wine gallons, and, divided by 282, (note to table, beer meas.) will give the content in ale or beer measure.

In this process, we see that the square of the mean diameter will be multiplied by '7854, and divided, for wine gallons, by 231. Hence we may contract the operation by only multiplying by their quotient, $\cdot\frac{7854}{231}$='0034) that is, by '0034 (or by 34, pointing off 4 figures from the product for decimals.) For the same reason we may, for *beer* gallons, multiply by ($\cdot\frac{7854}{282}$='0028, nearly) '0028, &c.

Hence this concise RULE *for guaging or measuring casks*: *Multiply the square of the mean diameter by the length; multiply this product by* 34, *for wine, or by* 28 *for beer, and pointing off four decimals, the product will be the content in gallons and decimals of a gallon.*

In the above example, the bung diameter, 31 in.—25 in. the head diameter=6 in. difference, and $\frac{2}{3}$ of 6=4 inches; 25 in.+4 in.=29 in. mean diameter.

Then 29^2=841, and 841×36 in.=30276.

Then, { 30276×34=1029384. Ans. 102'9384 wine gals.
{ 30726×28=847728. Ans. 84'2728 beer gals.

190. How many wine gallons in a cask whose bung diameter is 36 inches, head diameter 27 inches, and length 45 inches? Ans. 166'617.

191. There is a lever 10 feet long, and the *fulcrum*, or prop, on which it turns is 2 feet from one end; how many pounds weight at the end, 2 feet from the prop, will be balanced by a power of 42 pounds at the other end, 8 feet from the prop.

Note. In turning around the prop, the end of the lever 8 feet from the prop will evidently pass over a space of eight inches, while the end 2 feet from the prop passes over a