ſquare root is 12, which is the required diameter of the pump.

2. To find the proper diameter of the cylinder.

The piſton is to be loaded with 7,64 pounds on every ſquare inch. This is equivalent to six pounds on a cir­cular inch very nearly. The weight of a cylinder of wa­ter an inch in diameter and a fathom in height is 2 1/24pounds, or nearly 2 pounds. Hence it follows that *6 c2* muſt be made equal to 2fp2, and that *c2* is equal to 2fp2/6, or to fp2/3.

Hence the following rule : Multiply the ſquare of the diameter of the pump-piſton (found as above) by the fathoms of lift, and divide the product by 3, the ſquare root oſ the quotient is the diameter of the cy­linder.

Suppoſe the pit to which the foregoing pump is to be applied is 24 fathoms deep ; then 24 x 144/3 gives 1152, of which the ſquare root is 34 inches very nearly.

This engine conſtructed with care will certainly do the work.

Whatever is the load of *water* propoſed for the en­gine, let 10 be the pounds on every circular inch of the ſteam-piſton, and make c2=p2 x 2f/m and the ſquare root will be the diameter of the ſteam-piſton in inches.

To free the practical engineer as much as poſſible from all trouble of calculation, we ſubjoin the following *Table of the Dimensions and Power of the Steam Engine,* drawn up by Mr Beighton in 1717, and fully verified by practice since that time. The meaſure is in Engliſh ale gallons of 282 cubic inches.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diam. of pump. | Holds in one yard. | Draws by a 6 feet stroke. | Weighs in one yard. | At 16 strokes *per* min. | Ditto in hogsheads | Ditto *per* hour. | **<υ \*U .≡ .s**  Jm **<v**  **.≡ \*>v**  **Q M-,**  **O**  **≡**  **Γβ**  **P** | The depth to be drawn in yards. | | | | | | | | | | | |
| Inch. | Gall. | Gall. | 1 .b. avoir | GUI. | Hd.∣Gal | Hd. Gall. | 15 | 20 | 25 | 3o | 35 | 40 | 45 | 50 | . 60 | 1 7o | 8c | 90 |
| 12 | \*4,4 | 28,8 | 146 | 462 | 7.21 | 440. 1 | r18⅛ | 2l∣ | 24 | 26f | 28f | 3=1 | 32f | 34i | 37i | 40 | 43-1 |  |
| I t | 12,13 | 24,26 | ι≡M | 338 | 6.20 | 369∙33 | 17 | 19i | 22 | 25 | 26-ſ | 28 | 29i | 314 | 34∣ | 37 | 39⅜ |  |
| IO | 10,02 | -20,04 | 102 | 320 | 5∙5 | 304.48 |  | 18 | 20 | 22 | 233 | 25i | *lΙ* | 28^ | 31⅛ | 34 | 36 | 38a. |
| 9 | 8,12 | 16,24 | 82,7 | 259,8 | 4∙7 | 247.7 | 14 | 16∣ | 18 | 20 | 21⅜ | 23 | 24i | 25 | 28 | ∣3°4 | 33 | 35 |
| 8∙τ | 7,20 | 14,52 | 73>9 | \*32>3 | 3∙43 | 221.15 | i34 |  | 17i | 19 | 20¾ | 21i | 23 | 24 | 264 | 28j | 31 | 3\*i |
| 8 | 6,4l | 12,82 | 65,3 | 20y,2 | 3.16 | 195.22 | I2f | ’4» | ι6f | i 84 | 19 | 2 of | 2l÷  1 | 23 | 25 | 27 | 29 | 3°τ |
| 7⅛ | 6,01 | 12,02 | 61,2 | ,92>3 | 3∙2 | 182.13 | (2 | •4 | Hi | '7⅛ | i83 | '9∣ | 21 | 22 | 24i | 26 | 28 | 29ji |
| 71 | 5,66 | ι≡>32 | 57,6 | 18r,ι | 2∙55 | 172.30 | I I | 13≈ | 15 | 16⅜ | 18 | æ9 | 20 | 2I∣ | 23i | 25 | 27 | 281 |
| 7 | 4>91 | 9>82 | 50,0 | <57ri | 2.31 | 149.40 | ιol | i3 | H |  | 16∣ | 18^ | 19 | 2 Of | 22 | 24 | 25⅜ | 27^1 |
| 61 | 4,23 | 8,46 | 43 | l35>3 | 2.9 | 128.54 | IO | 12 | 13 | ,4 | 15\* | ι6f | 18 | 19 | 20 | 22 | 23 | 24-t- |
| 6 | 3>6∙ | 7,2 | 36,7 | 115J | 1.52 | J 10.1 | 9i | I I | 12 | 13 | 14 | ,5f | 16 | ‘7 | 19 | 2θ4 | 22 | 232 |
| 5τ | 3>13 | 6,2 | 3i>8 | 99>2 | 1.36 | 94∙3o |  | 10 | I I | 12 | 13 | ,4 | 15 | l5i | Π | i9 | 20 | 21 |
| 5 | 2,51 | 5>o | 25,5 | 80,3 | i∙7 | 66.61 |  |  | 10. | I I | II⅜ | 13 | i3∣ | 14 |  | I 61 | 18-i- | 19l |
| 4τ | 2,02 | 4,04 | 20,5 | 64,6 | 1.1 | 60.60 |  |  |  | 10 | I I | x1∣ | 12 | 13i | 14 | 15 | 16 | \*72 |
| 4 | 1,6 | 3>2 | I 6,2 | ST | 0.5 I | 48.51 | 1 |  |  |  | 9 | 10 | I I | Hi | 12 | 134 | U | 15 |

The firſt part oſ the table gives the fize of the pump ſuited to the growth of water. The ſccond gives the ſize of the cylinder ſuited to the load ofwate-. If the depth is greater than any in this table, take its fourth part, and double the diameter of the cylinder. Thus if 150 hogſheads are to be drawn in an hour from the depth of 100 fathoms, thelaſt column of part firſt gives for 149.40 a pump of 7 inches bore. In a line with this, under the depth of 50 yards, which is ⅛th of loo fathoms, we find 20⅛, the double of which 1341 inches for the diameter of the cylinder.

It is almoſt impoſſible to give a general rule for ſtrokes of different lengths, &c. but any one who pro- feſſes the ability to erect an engine, ſhould ſurely know as much arithmetic as will accommodate the rule now given to any length of ſtroke.

We venture to ſay, that no ordinary engineer can tell *à priori* the number per minute which an engine will give. We took ιz ſtrokes of fix feet each fora ſtandard, which a careful engineer may ealily accom- pliſh, and which an employer has a right to expect, the engine being loaded with7 water to half the preſſure of the atmoſphere : if the load be leſs, there is ſome fault — an improper counter weight, or too little boiler, or leaks, &c. &c.

Such is the ſtate in which Newcomen’s ſteam-engim· had continued in uſe for 60 years neglected by thepbi- loſopher, although it is the moſt curious object vzhich human ingenuity has yet offered to his contemplation, and abandoned to the efforts of the unlettered artiſt. Its uſe has been entirely confined to the raffing of water. Mr Keane Fitzgerald indeed publiſhed in the Philoſophi- cal T raiTſactions a method of converting its recipt ocating motion into a continued rotatory motion by employing the great beam to work a crank or a train of wheel-work. As the real action of the machine is confined to its work­ing ſtroke, to accompliſh this, it became neceſſary to connect with the crank or wheeled work a very large and heavy fly, which ſhould accumulate in itſelf the whole pr eſſure of the machine during its time of action, and therefore continue in motion, and urge forward the working machinery while the ſteam engine was go­ing through its inactive returning ſtroke. This will be the caie, provided that the refiſtance exerted by the working machine during the whole period of the work­ing and returning ſtroke of the ſteam-engine, together