

fully satisfied to what degree of exactness it can be made to answer the end proposed, I am,

Gentlemen,

June 4, 1752.

Your most obedient

humble servant,

J. Ellicott.

LXXXII. *A Description of a new Tackle or Combination of Pullies, by Mr. J. Smeaton,*

Read June 11, 1752. **T**HE axis *in peritrochio*, and the compound pulley, are the only mechanic powers, which can with convenience be applied to the moving large weights, when the height, to which they are intended to be raised, is considerable. The excellence of the former is, their working with little friction; that of the latter, in their being easy to be moved from place to place, and applied *extempore*, as occasion requires.

The present methods of arranging pullies in their blocks may be reduced to two. The first consists in placing them one by the side of another upon the same pin; the other in placing them directly under one another, upon separate pins. But in each of these methods an inconvenience arises, if above 3 pullies are framed in one block. For, according to the first method, if above 3 pullies are placed by the side of one another, as the last line, by which the draught
is

is made (or, as it is commonly called, the fall of the tackle) must necessarily be upon the outside pulley or shieve; the difference of their friction will give it so great a tendency to pull the block awry, that as much will be lost by the rubbing of the shieves against the block, on account of its obliquity, as will be got by increasing the number of lines.

The second method is free from this objection; but, as the length of the two blocks, taken together, must be equal to the sum of the diameters of the six pullies, besides the spaces between for the ropes, and the necessary appendages of the framing, were there more than three pullies in each block, they would run out into such an inconvenient length, as to deduct very considerably from the height, to which the weight might otherwise have been raised: so that, upon those accounts, no very great purchase can be made by the common tackles of pullies alone.

In order therefore to increase its power, sometimes a second tackle is fixed upon the fall of the first; but here it is obvious, that whatever be the power of the second tackle, the height to which the weight might otherwise have been raised by the first, will be less in the same proportion as the purchase is increased by the second.

Again, very frequently the fall of the first tackle is applied to an axis *in peritrochio*, which increases the purchase very commodiously without the inconveniencies last-mention'd; but then the machine is render'd cumbersome, and, consequently, less fit for a moveable apparatus.

All those impediments I have avoided, by combining the two methods, above described, in one.

The

The pullies are here placed in each block in two tier; several being upon the same pin as in the first method, and every one having another under it, as in the second; as also that, when the tackle is in use, the two tier, that are the remotest from one another, are so much larger in diameter than those that are nearest, as to allow the lines of the former to go over the lines of the latter without rubbing.

From this construction arises a new method of new method of reeving the line upon the shieves: For here let the number of shieves be what it will, the fall of the tackle will always be upon the middle shieve, or on that next the middle, according as the number of pullies on each pin is odd or even.

To do this, the line is fixed to some convenient part of the upper block, and brought round the middle shieve of the larger tier of the under block, from thence round one of the same sort next to the centre one of the upper block; and so on till the line comes to the outside shieve, where the last line of the larger tier falls upon the first shieve of the smaller, and being reeved round those, till it comes at the opposite side, the line from the last shieve of the smaller tier again rises to the first of the larger, whence it is conducted round till it ends on the middle shieve of the upper block on the larger tier; as will appear more plain, by inspection of the figure annexed.

In this method all the lines are clear of one another, and the blocks are kept parallel. The model which I have the honour to shew the Society, and from which I made the draught, is a composition of 20 shieves, five on each pin. With this model, which may easily be carried in the pocket, I have raised

raised 600 weight. But with a tackle of this sort, properly executed in large, one man will easily raise a ton, and a greater number in proportion*.

I have tried several numbers of shieves as far as 36; but 20 seems to be the largest number, that will answer well in practice.

A very commodious tackle of 12 might be executed in wood, in the same manner that common blocks are made.

I should not have troubled the Royal Society with an account of this contrivance, did it not seem promising of much utility, in a variety of purposes; particularly for merchants, seamen, builders, engineers, &c. I therefore intirely submit it to the censure of that honourable body.

J. Smeaton.

P. S. In constructing a tackle of 20 for 3 tons, the larger tier of shieves should not be less than 8 inches, the running line needs not be thicker than half an inch diameter, and the iron pins need not be so thick.

* A large tackle of 20 was tried on board one of his Majesty's ships; and by the help thereof, tho' it was with a new rope, one man raised one of the ship-guns and carriage, that together weighed 27 hundred-weight; there being a person, as usual, to hold on, or prevent the rope from slipping back.

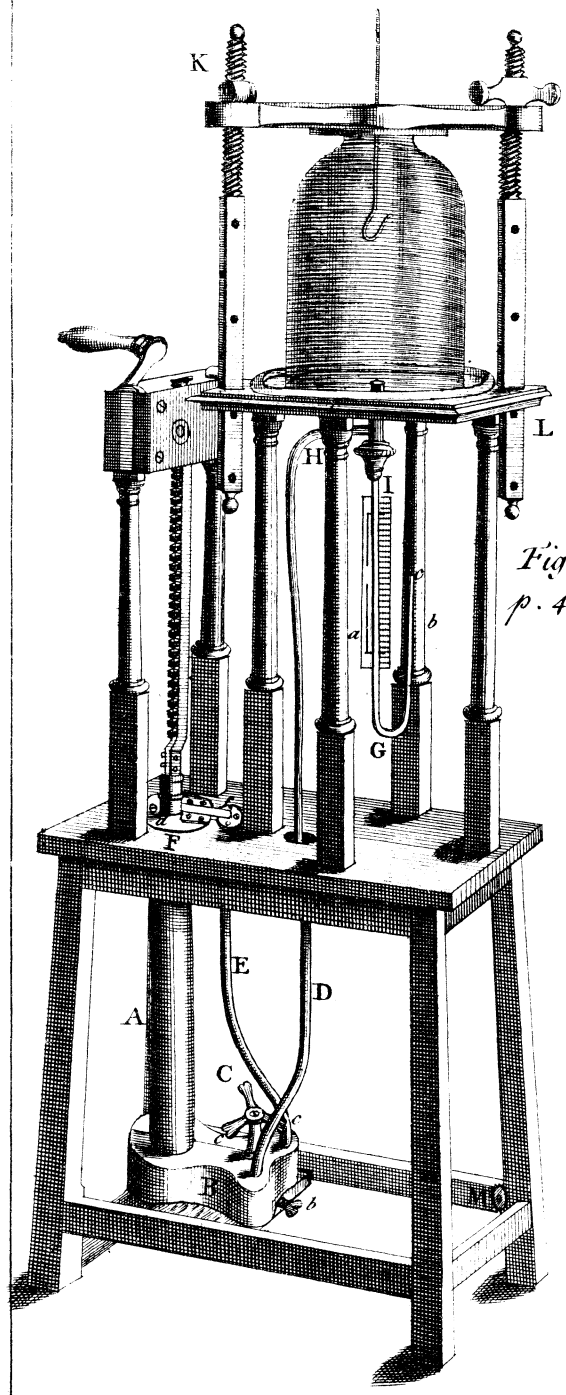


Fig. 1.
p. 424.

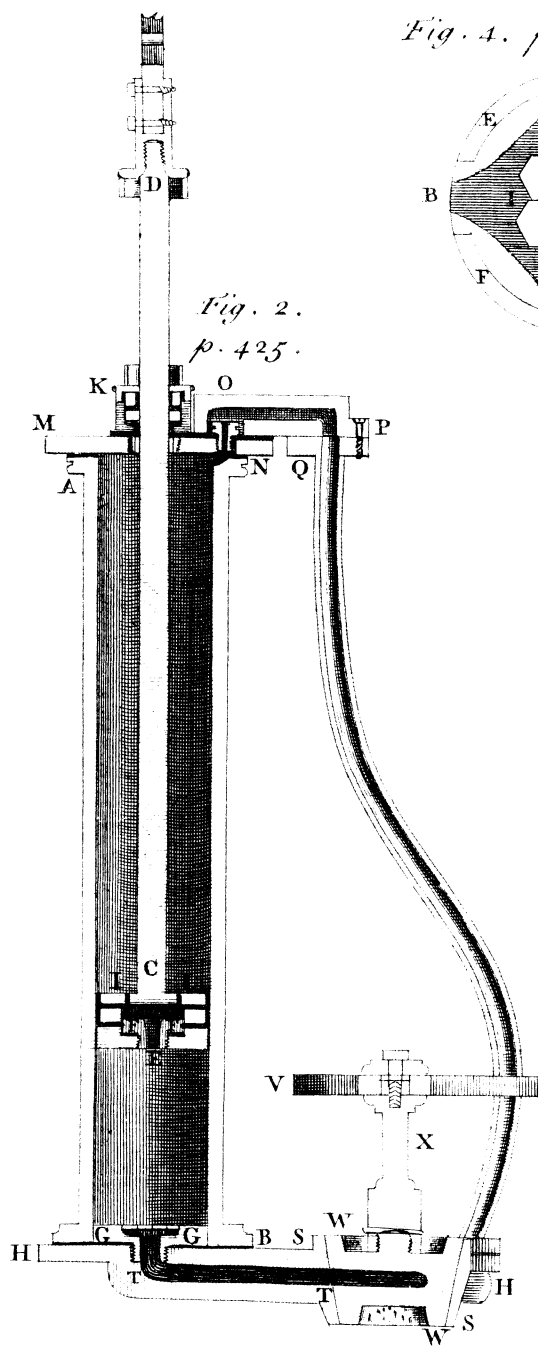


Fig. 2.
p. 425.

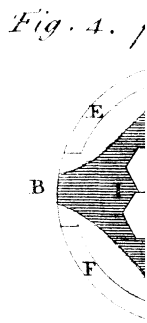


Fig. 4.

Fig. 4. p. 427.

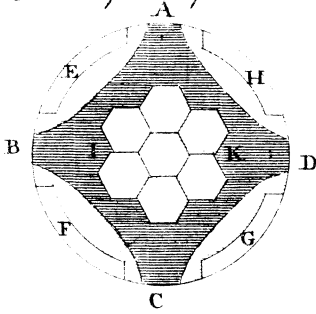


Fig. 2.
p. 425.

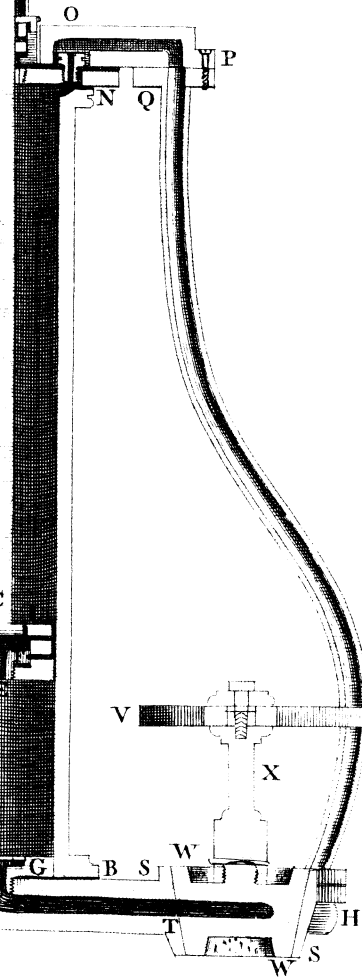


Fig. 5.
p. 428.

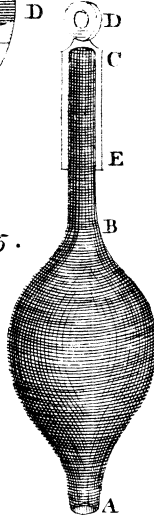


Fig. 3.
p. 426.

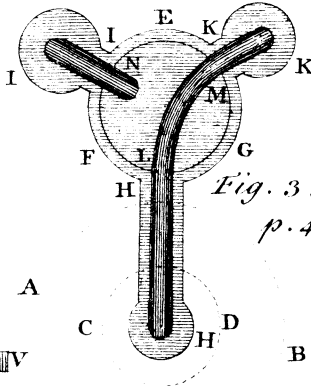
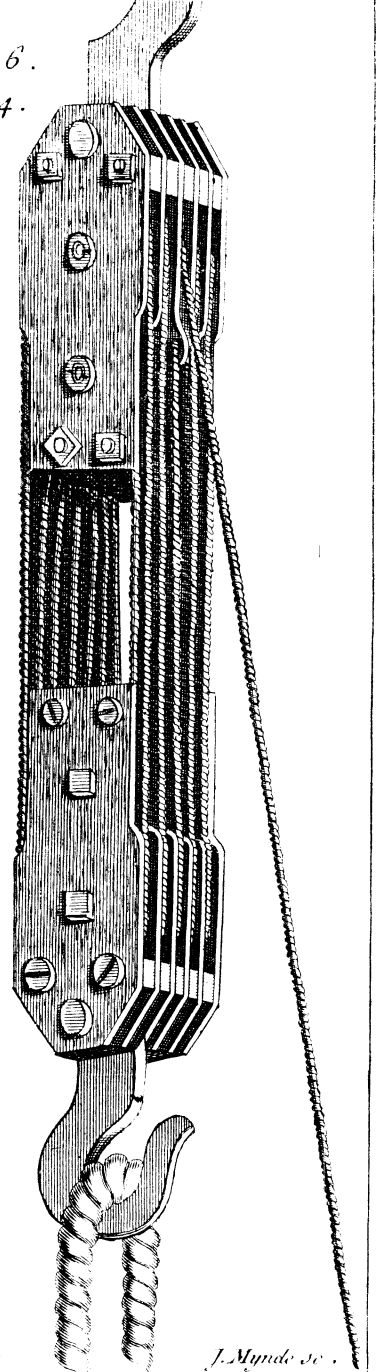


Fig. 6.
p. 494.



A Scale of Inches.

1 2 3 4

For Fig. 4.

J. Mynde sc.