## III. *A farther Examination of the Machine's ſaid to be without Friction. By the ſame.*

AT the laſt Meeting of the Society, I ſhew'd the Inconveniency of Monſ. *Perault*'s new kind of *Axis in Peritrochio*, or Roller fix'd into a large Pully; ſhewing not only, that by the Uſe of this Engine we muſt loſe Force, whoſe Value is ſeldom to be recompens'd by the Time we gain, but alſo that the Stiffneſs of the additional Ropes which wind about the Roller, in the Operation, gives more than double (ſometimes than triple or quadruple) the Friction of the ſame Engine us'd in the common Way, when the Pivot, or Iron Axis, is in Diameter the twelfth Part of the Diameter of the Roller, or wooden Axel.

But as ſome have endeavour'd to render this Engine more uſeful, by cauſing it to roll up an inclin'd Plane, inſtead of making it riſe directly up in the Manner deſcrib'd, and condemn'd in my former Paper; I thought proper to ſhew here what muſt be the Loſs of the Power in Proportion to the Inclination of the Plane.

I ſay therefore, that in every Inclination of the Plane, if the Sine of the Angle of Inclination be taken in Parts of the Radius of the Axel, or Roller, the Power will be to the Weight :: as the Radius of the Roller + the Sine of Inclination, to the Radius of the Wheel — the ſaid Sine of Inclination; that is, in the Figure, P (= 1) : W (= 3) :: $d\,k : a\,k$. (See Fig. 4.)

In

In the preſent Experiment B E is an inclin'd Plane, on which the Roller C is to roll up, touching the ſaid Plane at the Point *c*; A M is the Wheel behind that Plane, another ſuch Plane, and equally inclin'd, being alſo ſuppos'd, behind the Wheel, to ſupport the other End of the Roller.

The Lines of Direction of the Power and Weight being *a* P and *d* W, through the Point of Contact, or Center of Motion, *c* draws A D parallel to the Horizon, and perpendicular to *a* P and *d* W; through the Center of the Engine, C draws *a d* Parallel to A D. Suppoſe the Angle B *c* A of the Plane's Inclination to be 30°, the right Sine will then be equal to half the Radius; therefore dividing C 2 (the Radius of the Roller) into two equal Parts at *k*, if you draw *k c* and *C c*, the Angle *k c* C will be equal to B *c* A, and its Sine will be C *k*. Now ſince it is evidently the ſame thing to make uſe of *a d* for a Lever, whoſe Center of Motion is at *k*, as of A D equal and parallel to it with its Center of Motion at *c*; it follows that in this Inclination of the Plane, the Diſtance of the Weight *d k* is greater than *d* C (the Diſtance of the Weight in the common Uſe of this Engine) by the Addition of the Quantity C *k*, the Sine of the Angle of Inclination; and *k a*, the Diſtance of the Power is leſs than C *a* (the Diſtance of the Power in the common Way) by the Subtraction of the ſaid Quantity or Sine C *k*: conſequently that on an inclin'd Plane; the Power is to the Weight :: as D *c* : to *c* A. Q. E. D.

## COROLLARY I.

Hence it follows, that the Radius of the Wheel, and the Radius of the Roller being given, the Loſs

of Power may be found in any Inclination of the Plane. Thus, as here, the Power, which in the common Way wou'd be but $\frac{1}{5}$ of the Weight, muſt be $\frac{1}{3}$ Part of it: So if the Angle of the Plane's Inclination was but 11° 32′ the Power would be $\frac{1}{4}$ of the Weight, &c.

### Corollary II.

Hence follows alſo, that if the Plane B E be Horizontal, no Force of the Power will be loſt, becauſe $cg : cf :: CG : CF$.

### Scholium.

As the Friction of the winding of the Ropes, ſuch as B $c$ in the new Way, is greater than the Friction of the Pivot in the old Way (beſides the Friction of the Collars of the Counterpoiſe to the Engine) ſo that Friction diminiſhes, as the Ropes bear leſs Weight, according to the Diminution of the Angle of the Plane; and when the Plane is horizontal, and without a Counterpoiſe, even then the winding up of the Ropes, and Preſſure of the Roller againſt the Plane, is equal to the Friction in the common Way.

N.B. The Experiment is made here with Pivots twelve times leſs in Diameter than the Roller, and fine pliable Silk, inſtead of Ropes.

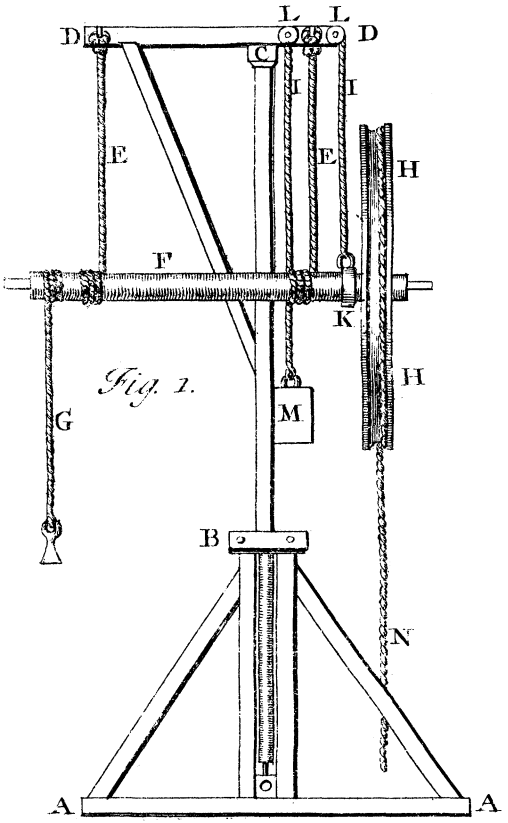


Fig. 1.

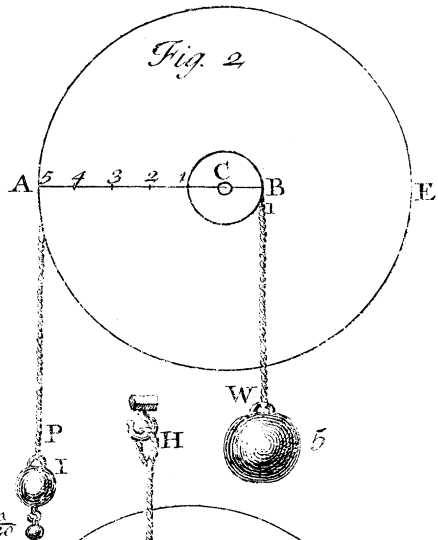


Fig. 2.

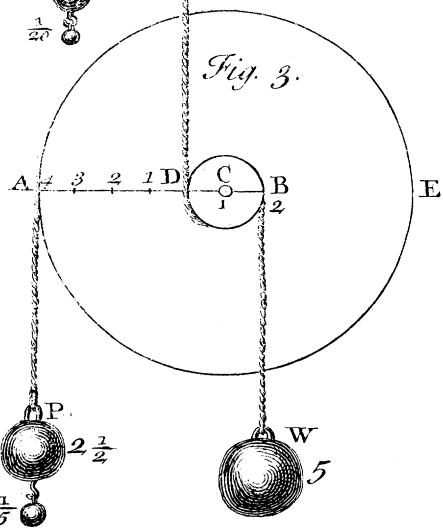


Fig. 3.

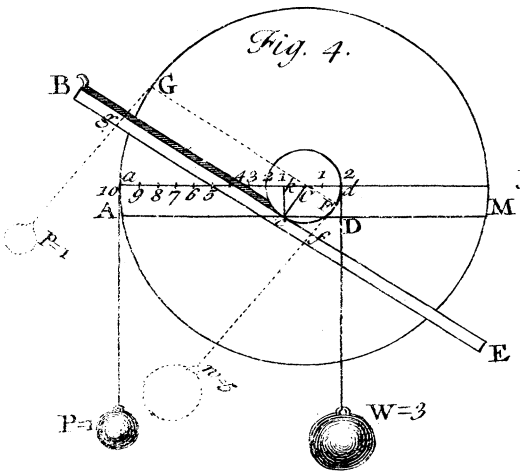


Fig. 4.