

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 *Monf. 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) :: dk : ak. (See Fig. 4.)

In

In the present Experiment BE is an inclin'd Plane, on which the Roller C is to roll up, touching the said Plane at the Point c ; AM 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 aP and dW , through the Point of Contact, or Center of Motion, c draws AD parallel to the Horizon, and perpendicular to aP and dW ; through the Center of the Engine, C draws ad Parallel to AD . Suppose the Angle BcA of the Plane's Inclination to be 30° , the right Sine will then be equal to half the Radius; therefore dividing Cz (the Radius of the Roller) into two equal Parts at k , if you draw kc and Cc , the Angle kcc will be equal to BcA , and its Sine will be Ck . Now since it is evidently the same thing to make use of ad for a Lever, whose Center of Motion is at k , as of AD 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 dk is greater than dC (the Distance of the Weight in the common Use of this Engine) by the Addition of the Quantity Ck , the Sine of the Angle of Inclination; and ka , the Distance of the Power is less than Ca (the Distance of the Power in the common Way) by the Subtraction of the said Quantity or Sine Ck : consequently that on an inclin'd Plane; the Power is to the Weight :: as Dc : to cA . 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 $\frac{2}{3}$ Part of it: So if the Angle of the Plane's Inclination was but $11^{\circ} 32'$ 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.

