V. *An Experiment to ſhew that the* Friction *of the ſeveral Parts in a* Compound Engine, *may be reduced to Calculation; by drawing Conſequences from ſome of the Experiments ſhewn before the* Royal Society *laſt Year, upon ſimple Machines, in various Circumſtances, by me. Now exemplified by the* Friction *in a Combination of* Pullies. *By* J. T. Deſaguliers. Jan. 14, 173$\frac{0}{1}$.

THE Machine conſiſts of three Pullies (two upper and one lower, or a Tackle of Three) whoſe Diameters are exactly as follows, 2 Inches, 1 $\frac{1}{2}$ Inch, 1 $\frac{1}{4}$ Inch; and all the Center Pins of $\frac{1}{4}$ Inch Diameter: The Rope being of $\frac{1}{10}$ Inch in Diameter.

The Weight is 18 Pounds *Averdupois*, and conſequently the Power to keep it in *Æquilibrio* muſt be = 6 ℔, and a very little more muſt make the Power raiſe the Weight, if there was no Friction; but here no leſs than 20 Ounces are required, though the Machine is as nicely made as it can poſſibly be.

I have ſhewn by Experiment, that when the Weight is unkown, $\frac{2}{3}$ of the Power is the Friction of a Cylinder whoſe Surface moves as faſt as the Power, and whoſe Gudgeons are equal in Diameter to the Cylinder. Now as the Diameter of the firſt Pulley is eight times bigger than its Pin, its Friction muſt be $\frac{4 \text{ ℔}}{8}$ or 8 Ounces.

The ſecond Pulley, whoſe Surface moves as ſlow again as the Power, and whoſe Pin is ſix times leſs in

Diameter muſt of Conſequence have its Friction of only $5\frac{1}{2}$ Ounces; becauſe

$$\frac{\frac{64\,℥}{2}}{6} = 5\tfrac{1}{3}\,℥$$

The third Pulley moving with $\frac{1}{3}$ of the Velocity of the Power, on a Pin of $\frac{1}{4}$ of its Diameter, has for its Friction $4\frac{1}{3}$ — ℥; becauſe

$$\frac{\frac{64\,℥}{3}}{5} = 4\tfrac{1}{3} - ℥$$

Now the Sum of all theſe Frictions being 17,6 ℥ which is the 5,4 Part of the Power 6 ℔, this Addition does ſo encreaſe the Friction as to require a Super-addition of the 5,4 Part of that firſt Addition, and ſo on, in this Series, ℥ 17,62 + 3,2 + 0,59, &c. = 21,41 ℥. Then the Sum of the Frictions upon account of bending the Ropes (too tedious to explain now, before I give a full Account in my intended Theory of Friction) deduced from the Experiment that a Rope of $\frac{1}{10}$ Inch in Diameter ſtretched by 6 ℔ requires 4,5 ℥ to bend it round a Cylinder of 1 Inch ——, amounts to 1,8 + 1,15 + 1,124 = 4,424 ℥, which, with the other Friction, amounts to 25,834 ℥. But as I have formerly ſhewn in theſe *Tranſactions*, that when a Rope drawn by unequal Weight runs over a Pulley, the Preſſure on the Pin is diminiſhed; that diminiſhed Preſſure (found by Calculation to be near 6 ℥) being taken from the above Sum, the Friction remaining will be 19,834 ℥; and the Experiment is juſt 20 3.

N. B. Nothing was here allowed for the Weight added to bend the Ropes, which would ſtill bring the Experiment nearer the Theory.