A POPULAR EXPOSITION OF THE EFFECT OF FORCES APPLIED TO DRAUGHT. PP. 1-73

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DAVID RANKINE

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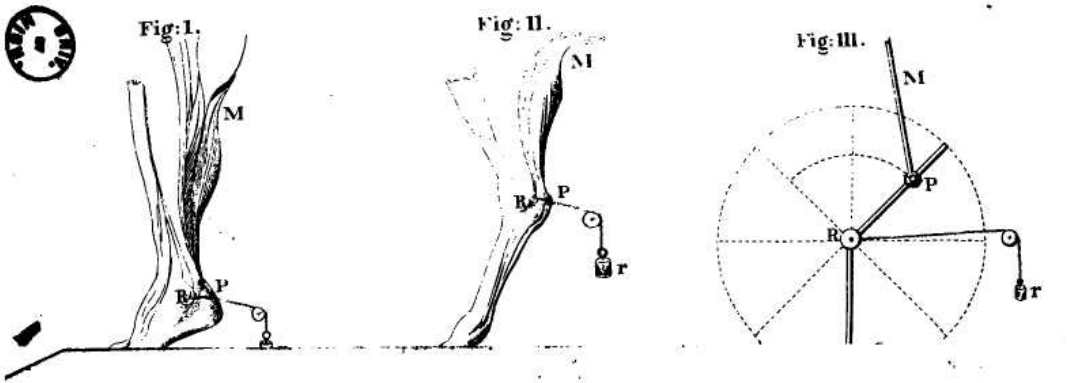
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A

POPULAR EXPOSITION

OF

THE EFFECT OF FORCES

APPLIED TO

DRAUGHT.

WITH ILLUSTRATIONS OF THE PRINCIPLES OF ACTION, AND TABLES OF THE PERFORMANCE OF

HORSES AND OF LOCOMOTIVE ENGINES

ON

RAILWAYS.

AND AN APPENDIX,

CONTAINING THE RESULTS OF SOME EXPERIMENTS ON

FRICTION.

By DAVID RANKINE, Esq.

Father of Professor W. J. Macquorn Rankine C.E. &c

". . . . axiomata illa vera, et solida, et viva, in quibus humanæ res et fortunæ sibi sunt."—Bacon.

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A

POPULAR EXPOSITION

OF

THE EFFECT OF FORCES APPLIED TO DRAUGHT.

OF THE RESISTANCE TO DRAUGHT ON LEVEL ROADS, OR FRICTION.

If a level surface were perfectly smooth and free from obstacles, a body resting upon it would oppose no resistance to horizontal motion, how heavy soever it might be. On such a surface a ship of the line would yield to the power of a child, as a planet is deflected from its usual orbit by the slightest adventitious force. It is superfluous to say that such a surface cannot exist in nature; but it is not so to add that it is the business of all road-making to approach to it as nearly as possible.

All surfaces are more or less covered with obstacles, consisting generally of particles or portions of the mat-

ter composing them; which either lie loosely and irregularly, as stones upon a common road; or, forming the superficial particles of a homogeneous aggregate, they present a fixed and uniform array, as on the surface of an iron rail, however smooth it may appear. It is of little importance to our present subject to form conjectures concerning the shape of the obstacles on surfaces of the latter description, where they are nearly beyond the perception of our senses: it is of no consequence whether we suppose them spherical, with Parent; or angular, with Euler: all that we are concerned in, is their effect in forming resistance to Draught, and the laws of their operation in so doing.

The resistance to the motion of bodies, arising from the obstacles on surfaces, is termed, Friction. When two surfaces are rubbed together, it is plain that the friction opposed to their sliding upon each other will be, in the first place, proportionate to the height of the obstacles upon them, or their degree of roughness; and, in the second place, to the amount of force that is applied in pressing the surfaces together, and consequently interserrating their obstacles, or causing them to crush or grind each other in the attrition. The above is termed *Sliding Friction* or *Friction of Attrition.* There is another description of friction called *Rolling Friction*, which is the resistance attend-