How Can the History and Philosophy of Science Contribute to Contemporary U.S. Science Teaching

Friday, 07 December 2012

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Organized by the School of Education and the Center for Philosophy and History of Science at Boston University.

How can the HPS contribute to Contemporary US Science Teaching

BU, Dez. 2012

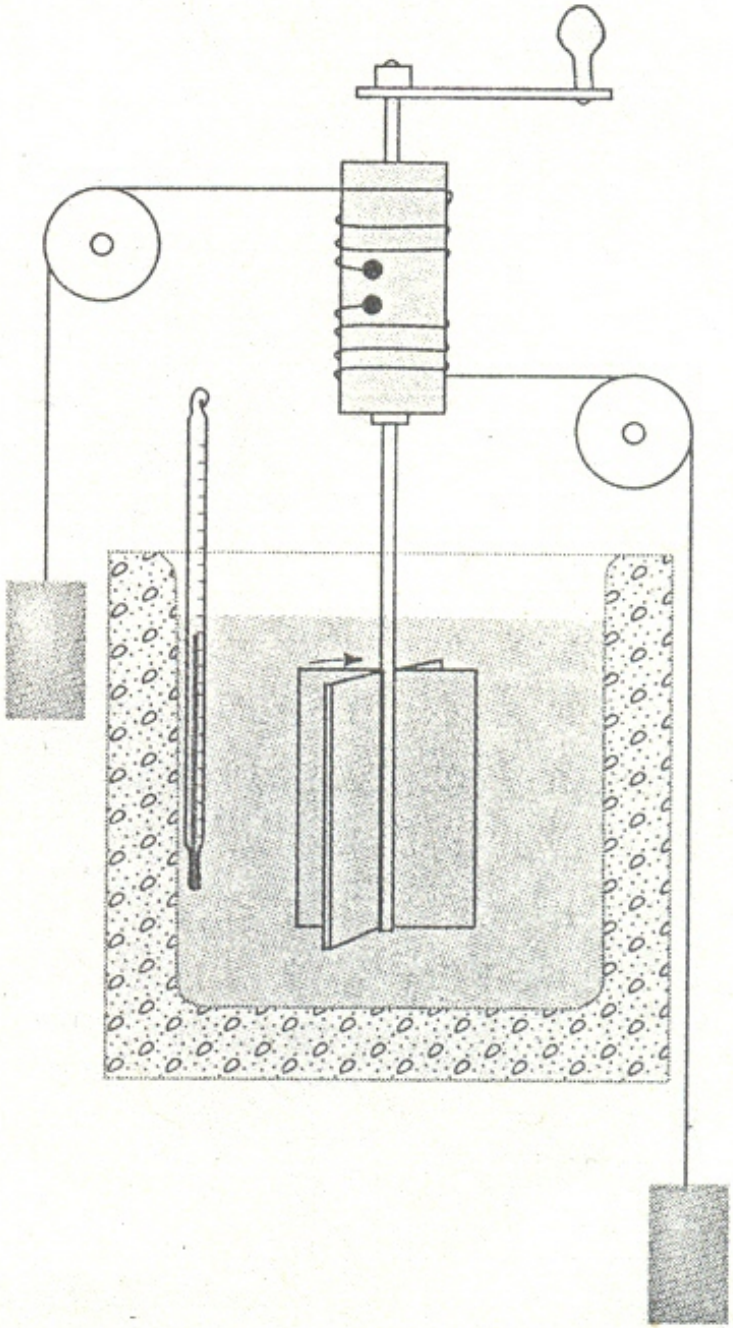
Ricardo Lopes Coelho

University of Lisbon

The Influence of History of Science Courses on Students' Views of Nature of Science

Fouad Abd-El-Khalick,[1] Norman G. Lederman[2]

- Conceptual HS
- Experimental HS
- History of Problem-Solving Strategies



8. The apparatus shown in Figure P11.8 was used by Joule to measure the mechanical equivalent of heat. Work is done on the water by a rotating paddle wheel, which is driven by two blocks falling at a constant speed. The tem-

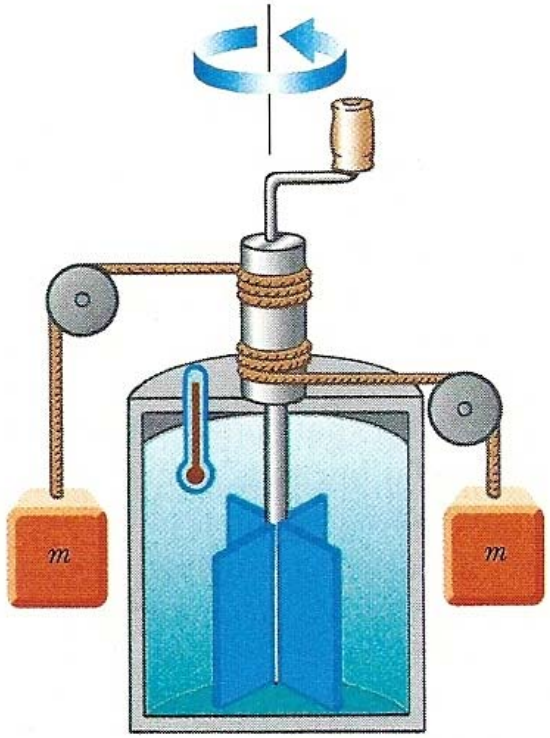
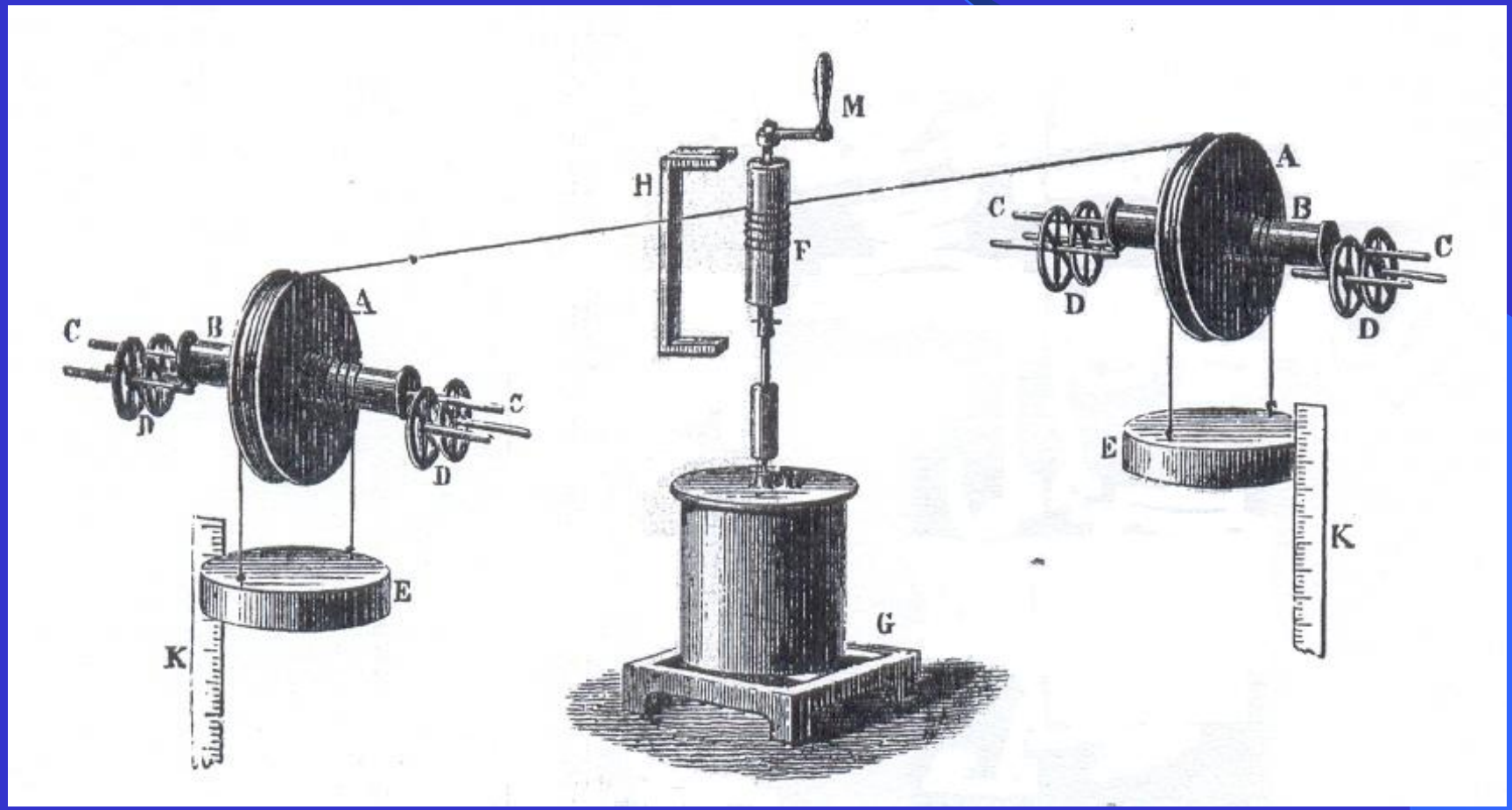


Figure P11.8 The falling weights rotate the paddles, causing the temperature of the water to increase.

Joule 1850 (Verdet 1868)



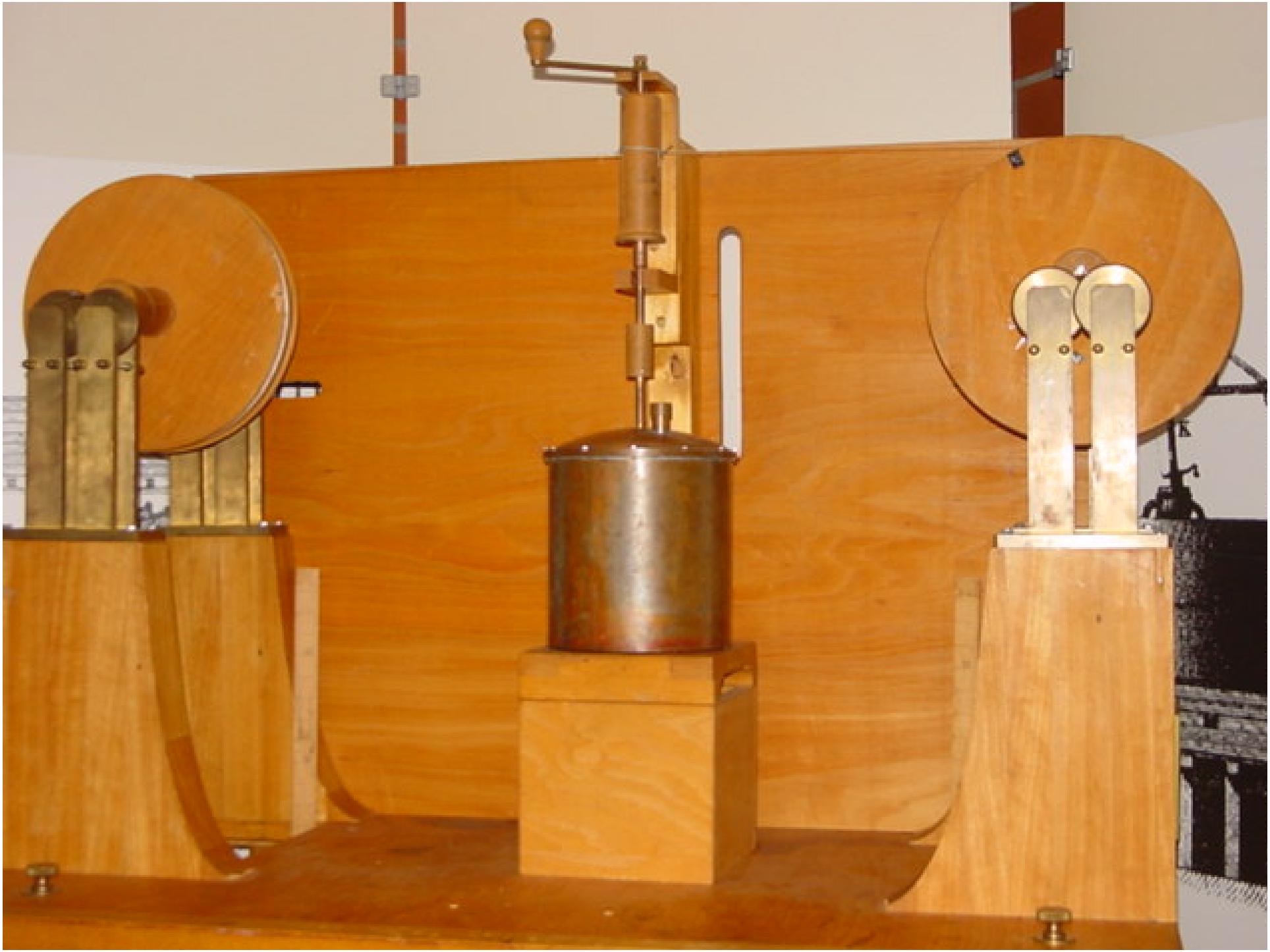


Fig. 70.

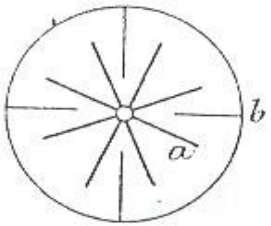


Fig. 69.

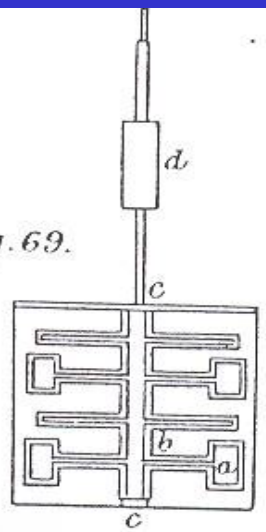


Fig. 72.

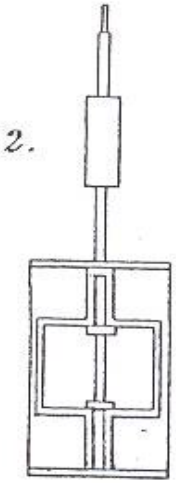
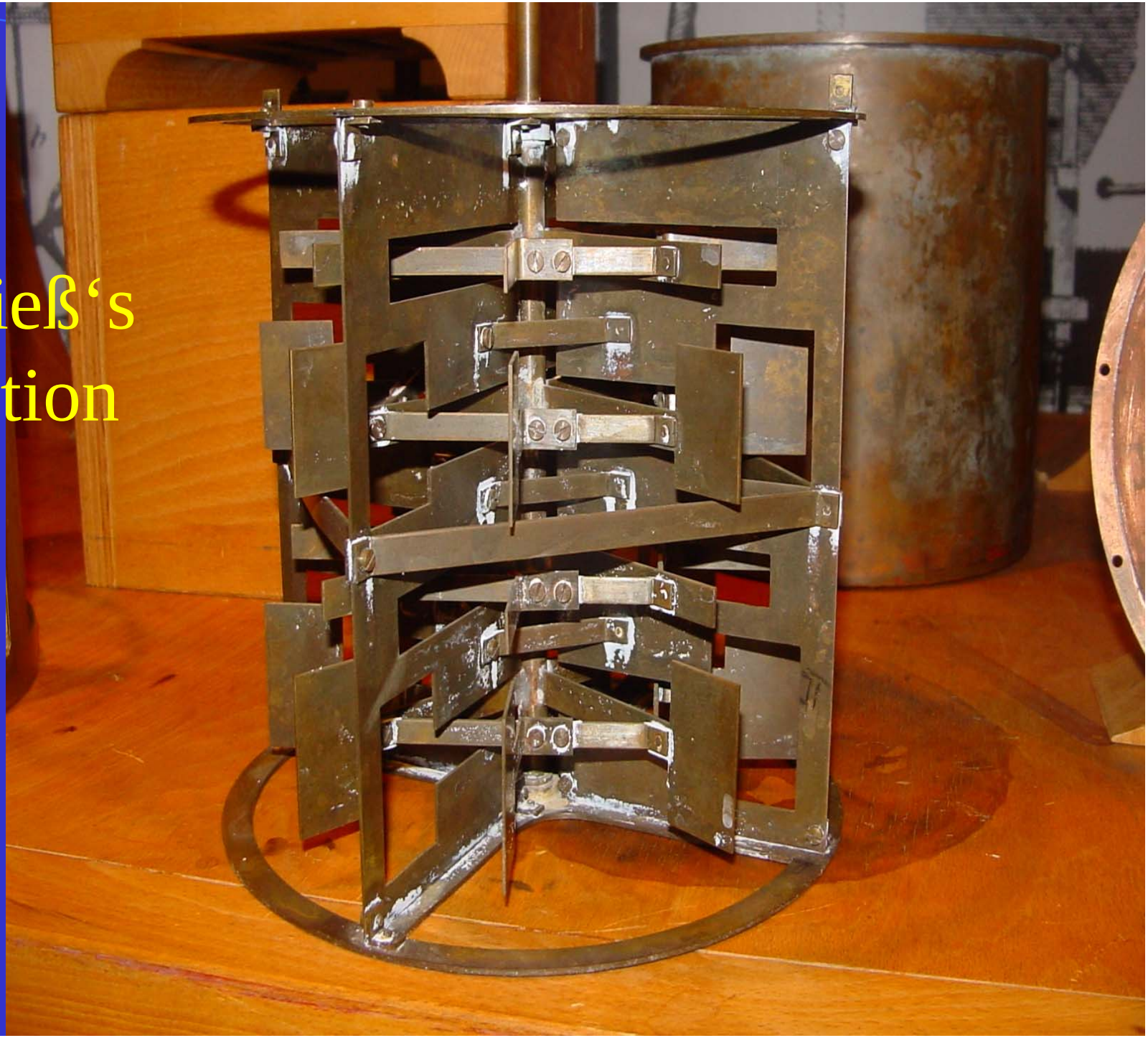
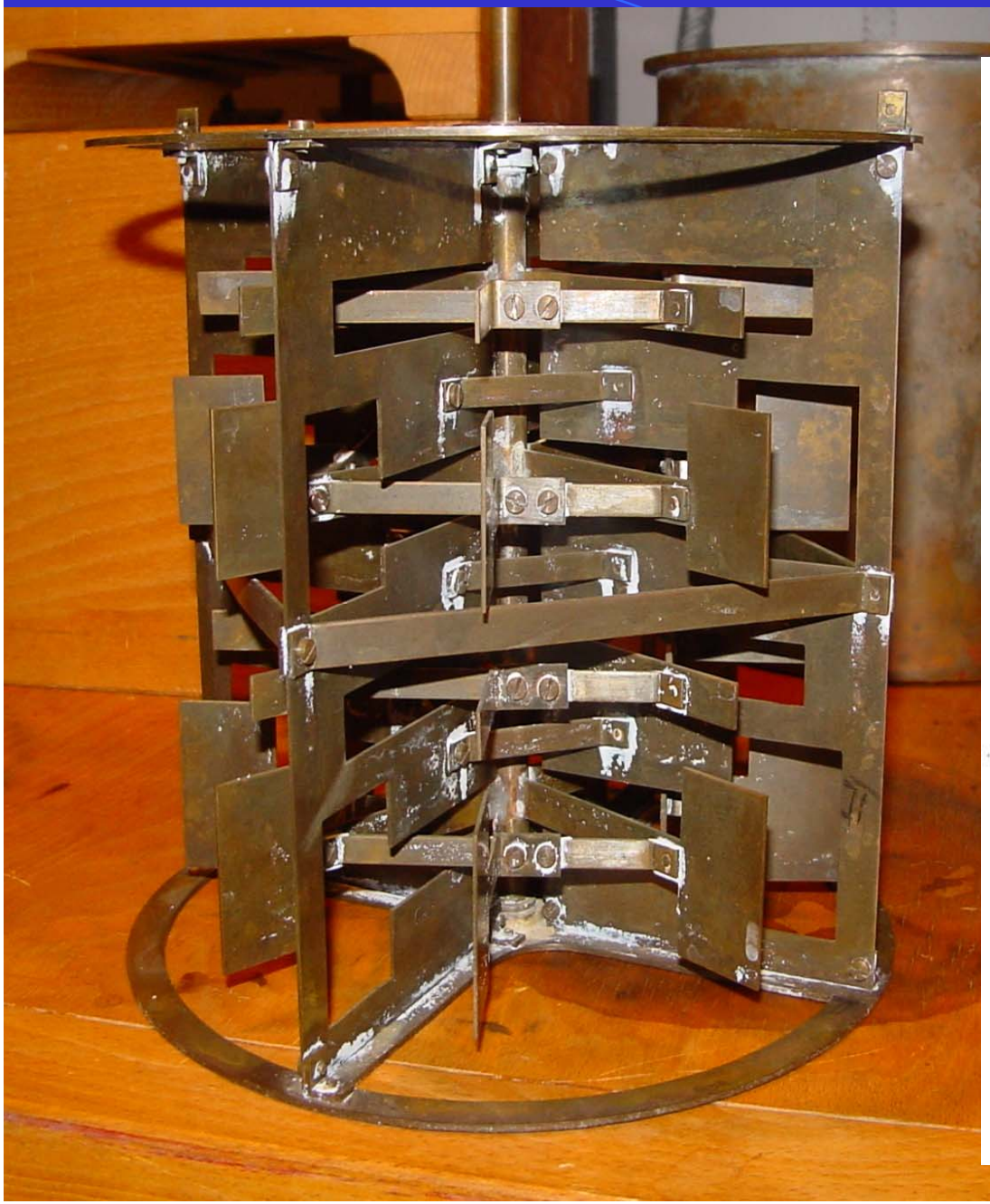


Fig. 73.

Falk Rieß‘s Collection





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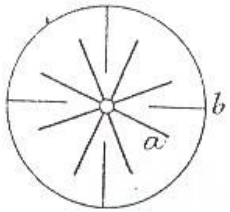

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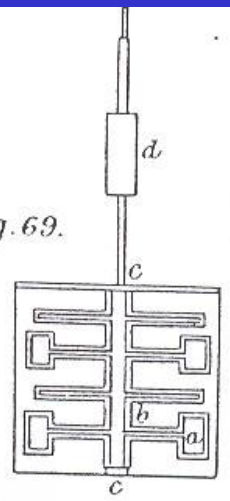

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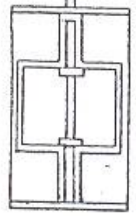

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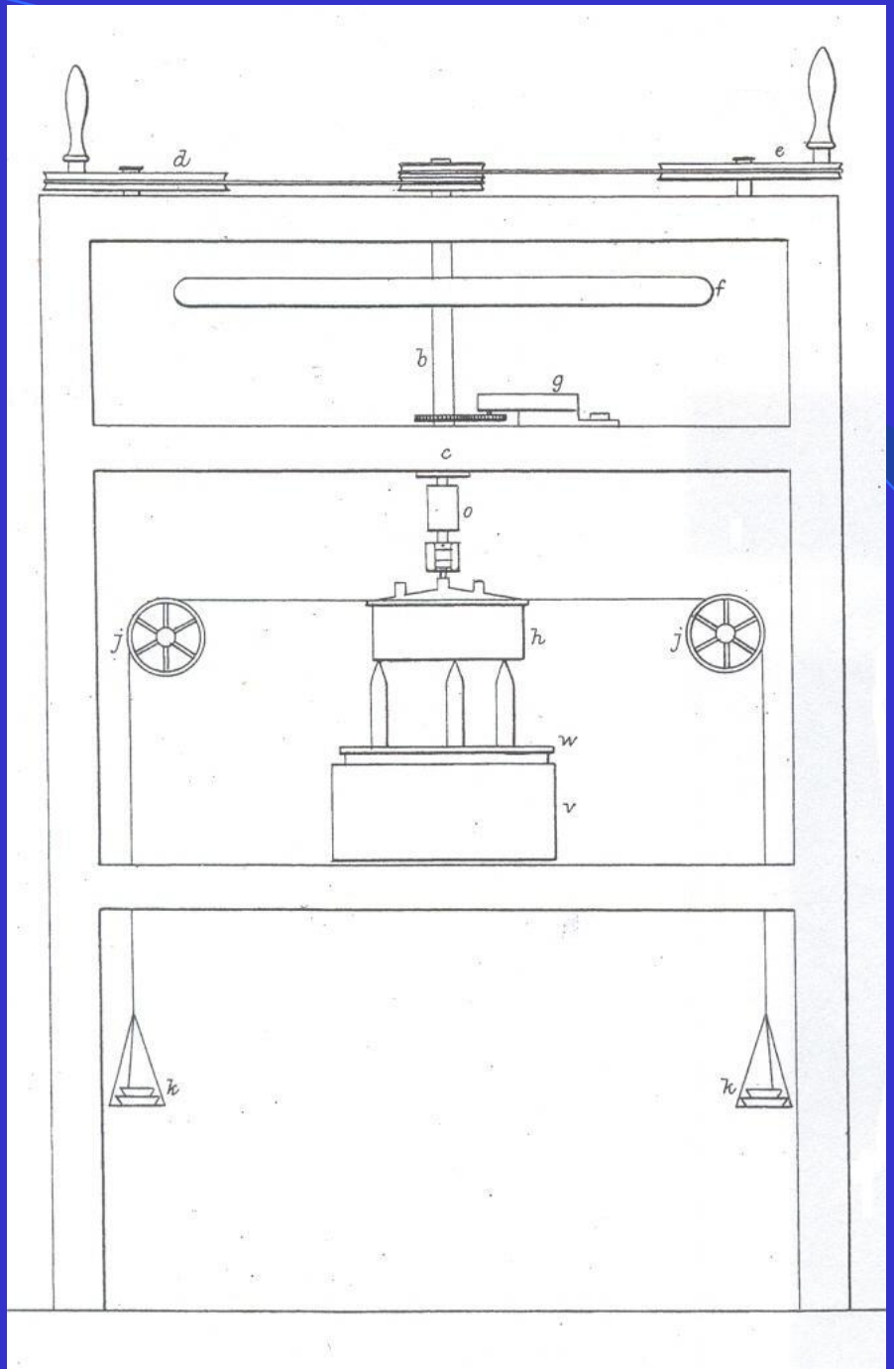
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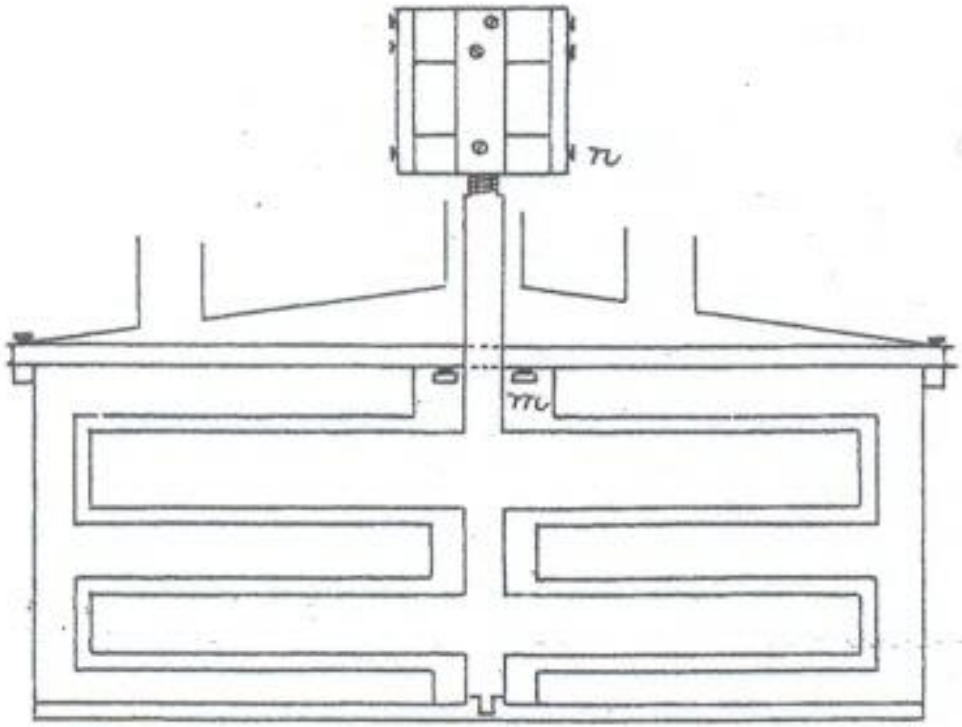

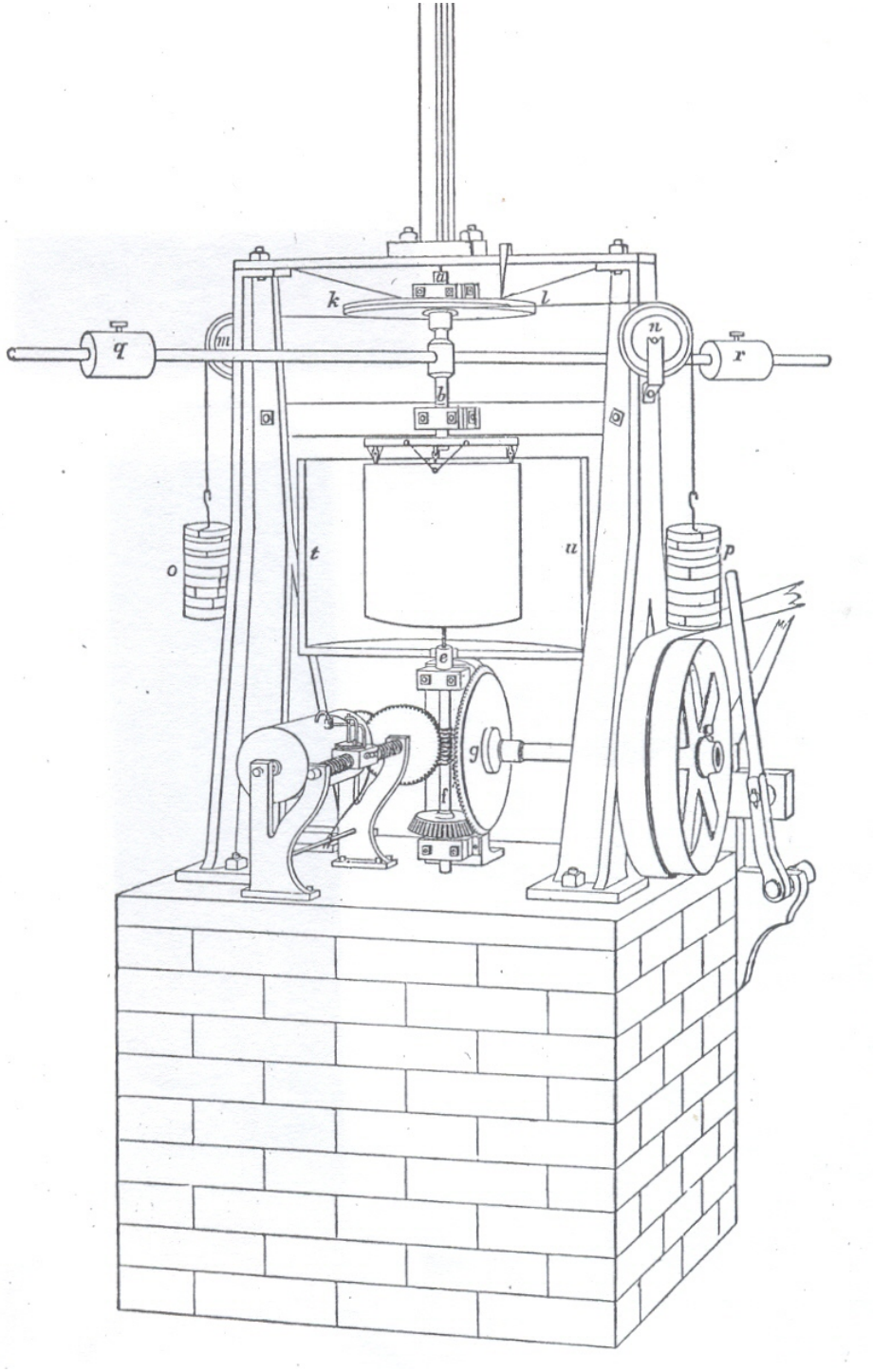
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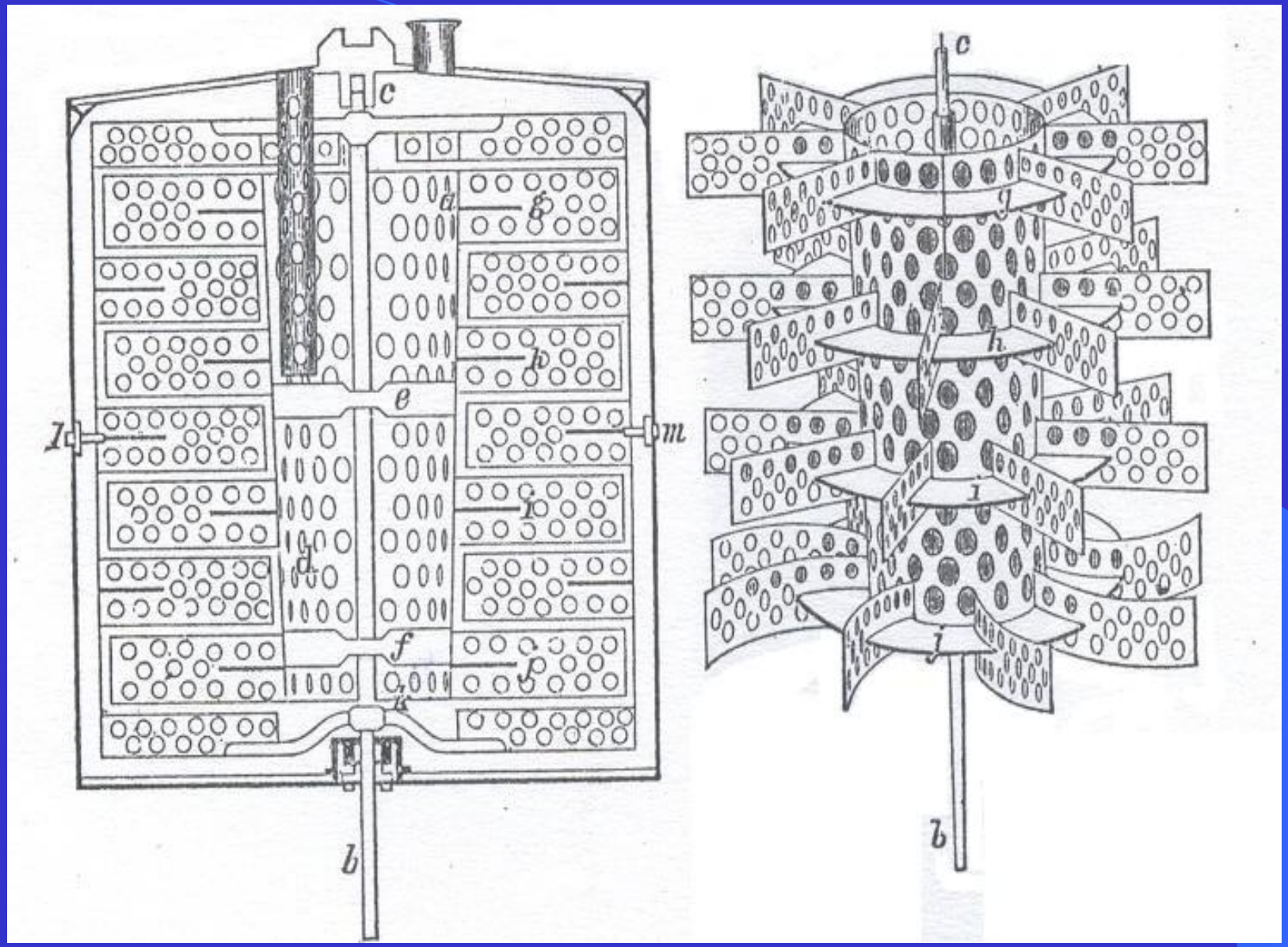
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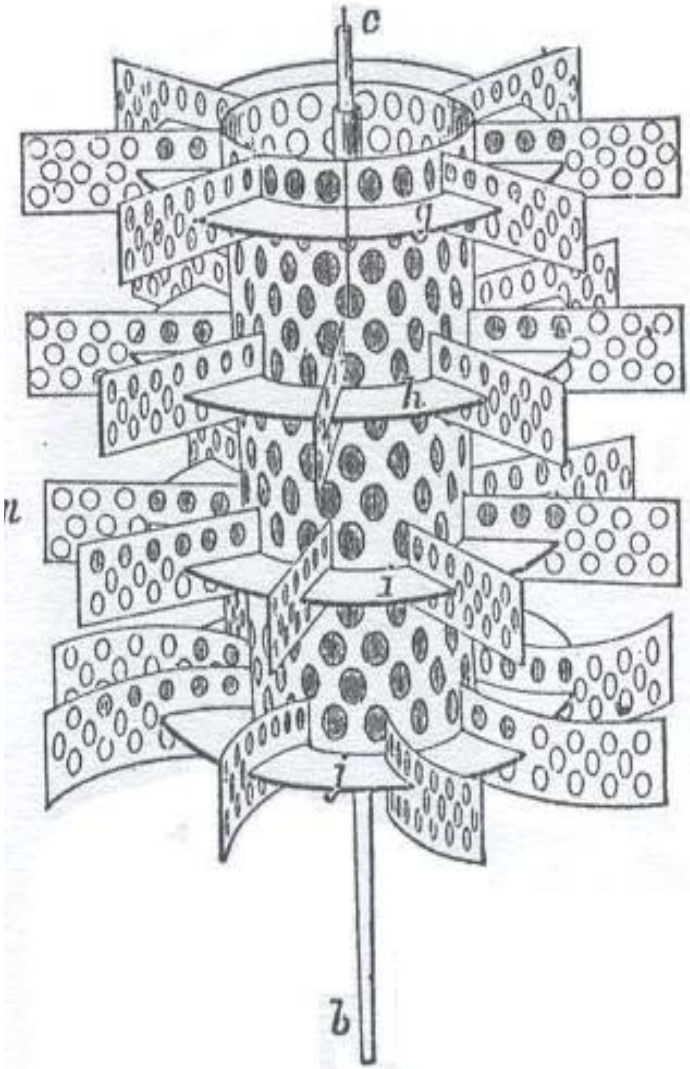
Joule's conclusion:

- 1. "***the quantity of heat produced by the friction of bodies*** *[…] is always proportional to the quantity of force expended*"
- 2. "*the quantity of heat capable of increasing the temperature of a pound of water […] by 1 °Fahr. Requires […] the expenditure of a mechanical force represented by the fall of 772 lb. through the space of one foot*" (p. 328).



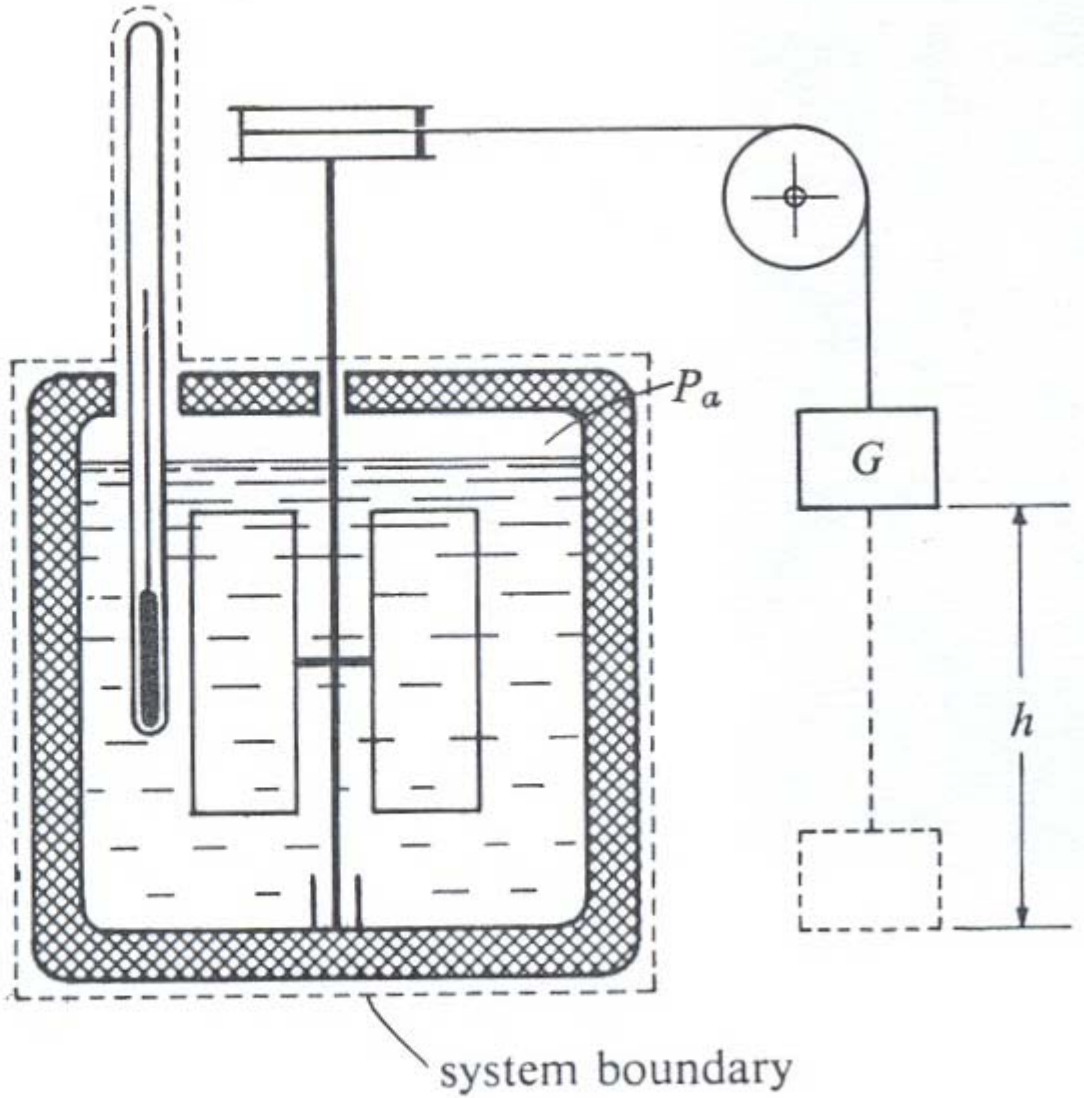


FIGURE 5.1. *Joule's experiment.*

What is energy?

- “It is important to realize that in physics today we have no knowledge of what energy *is*”, Richard Feynman.

- “Nobody knows what energy really is”, Bergmann and Schaefer’s *Experimental Physics*.

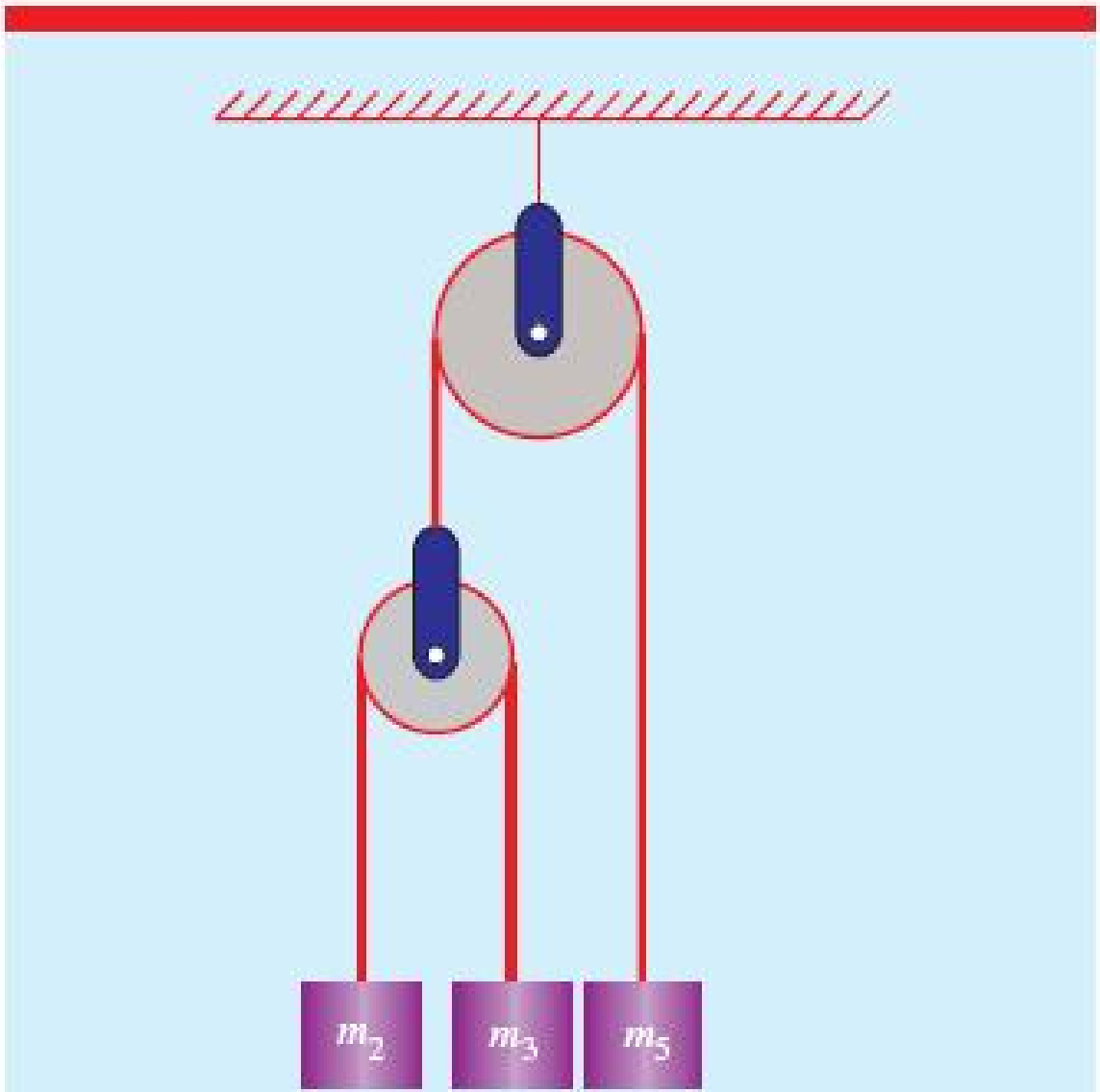


Figure 1. Sketch of the apparatus showing the two pulleys and the three masses. m_2 is 2 kg, m_3 is 3 kg and m_5 is 5 kg.

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When equal masses don't balance

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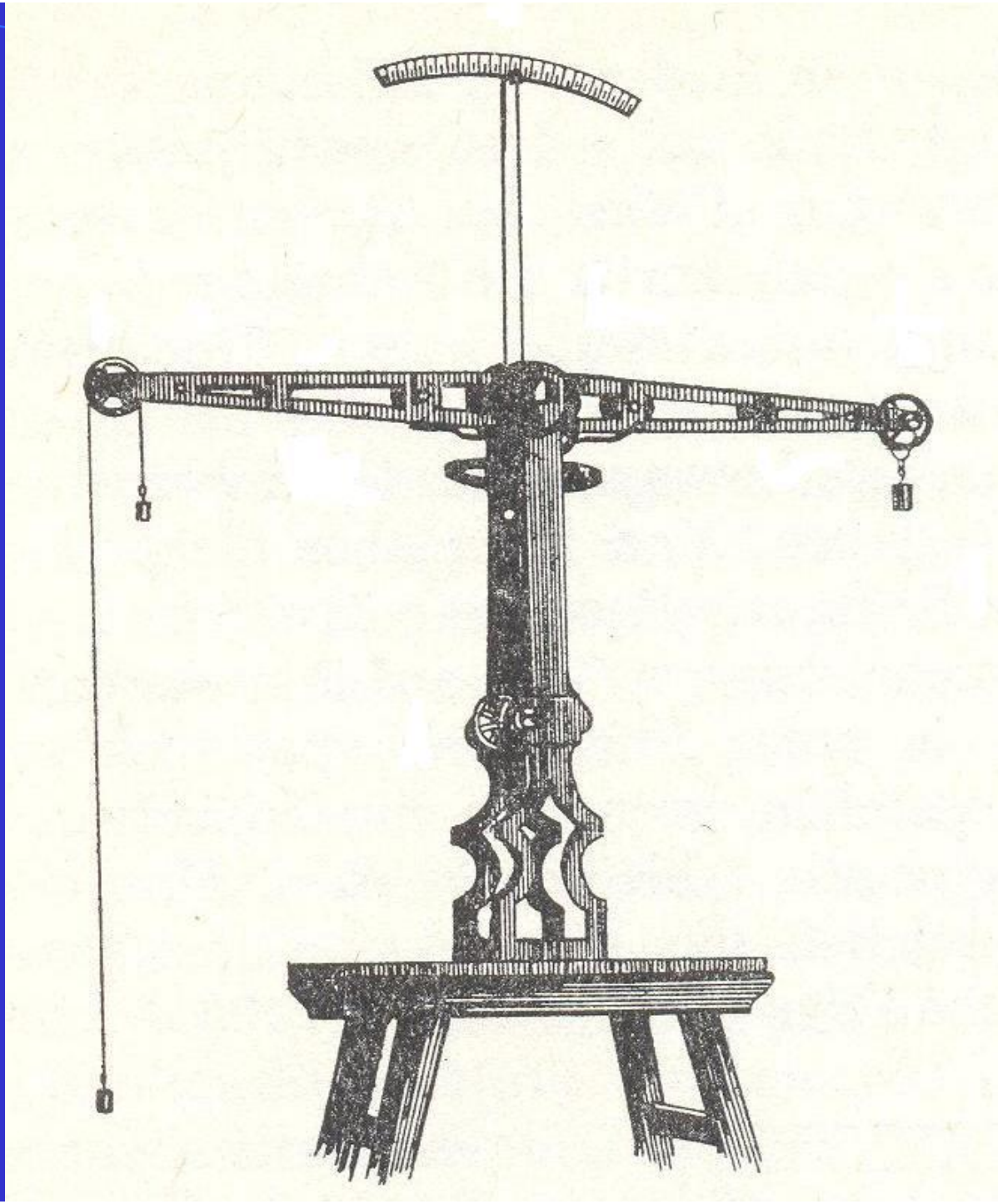
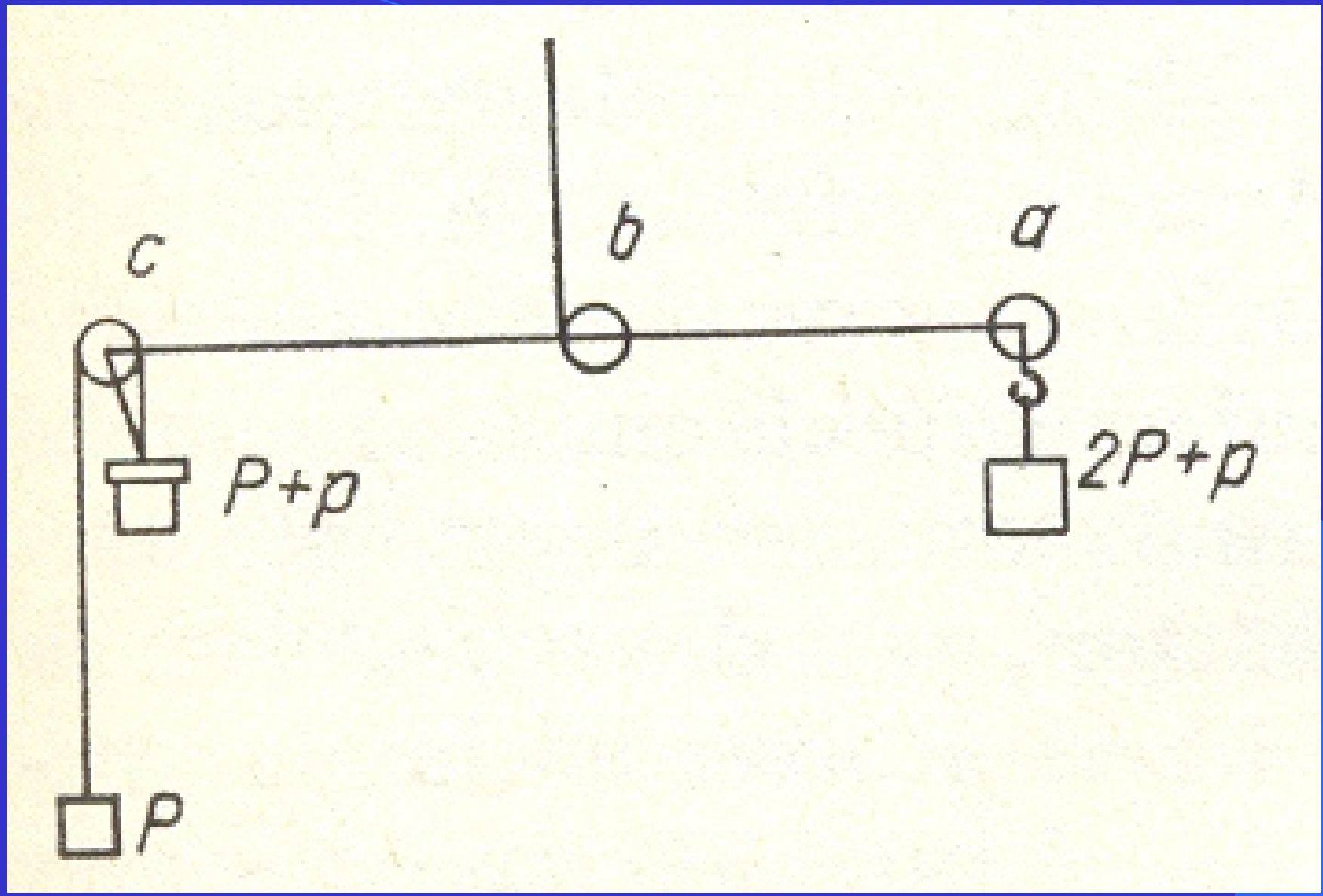
Abstract

We treat a modified Atwood's machine in which equal masses do not balance because of being in an accelerated frame of reference. Analysis of the problem illuminates the meaning of inertial forces, d'Alembert's principle, the use of free-body diagrams and the selection of appropriate systems for the diagrams. In spite of the range of these applications the analysis does not require calculus, so the ideas are accessible even to first-year students.

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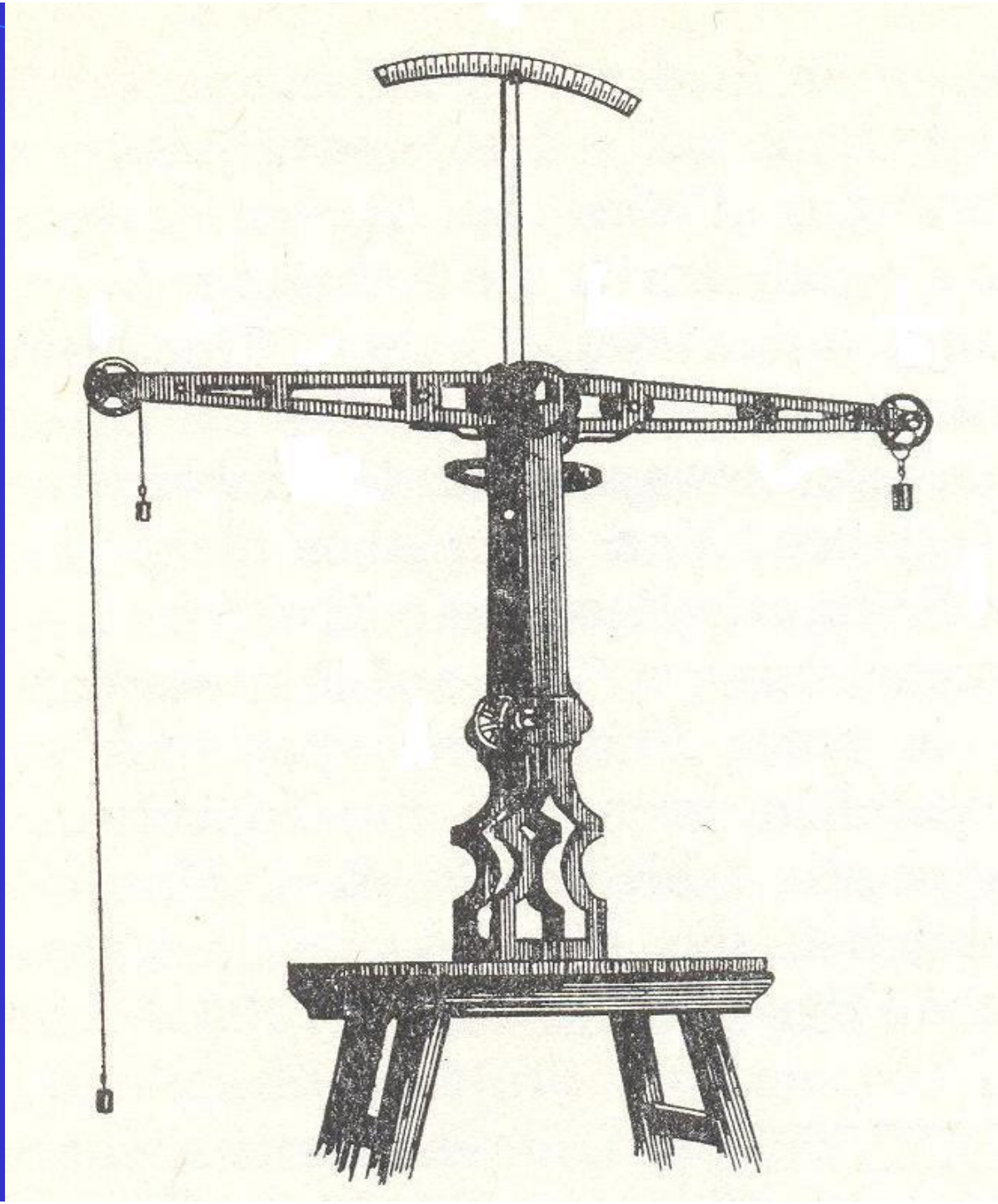
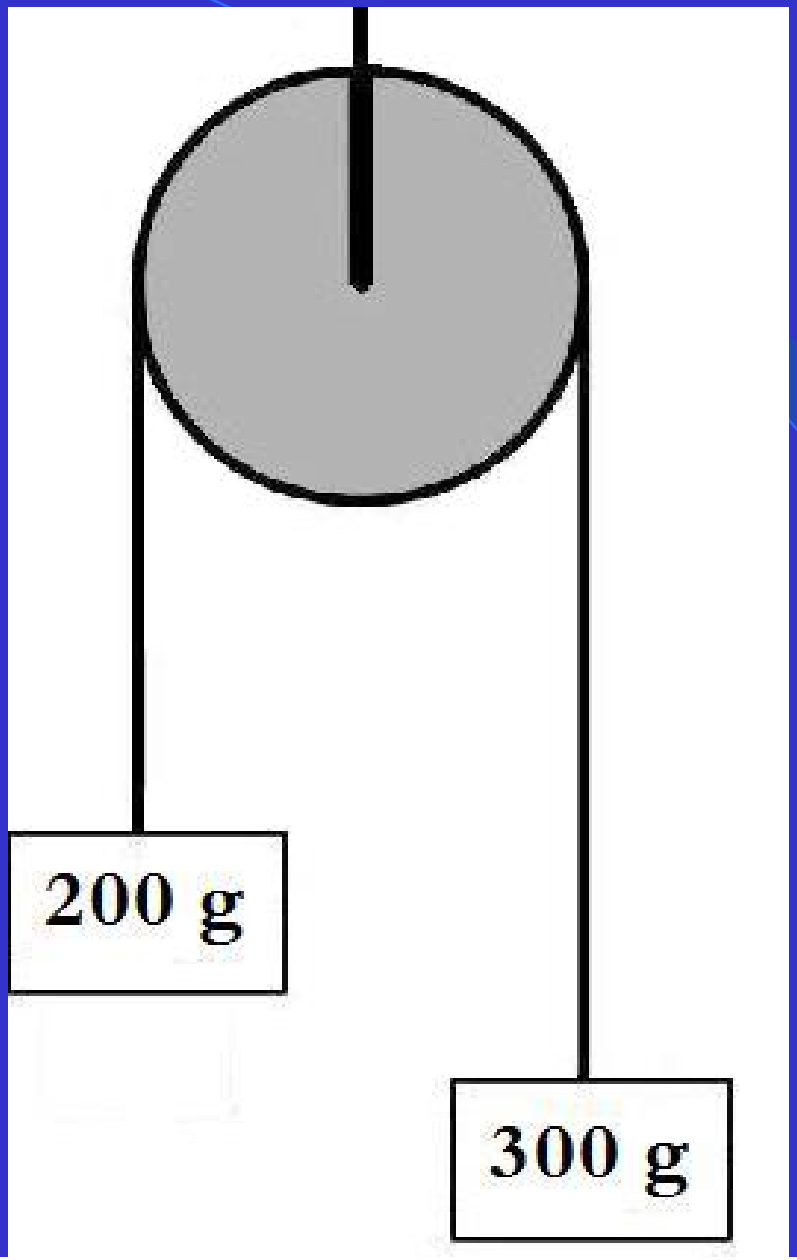
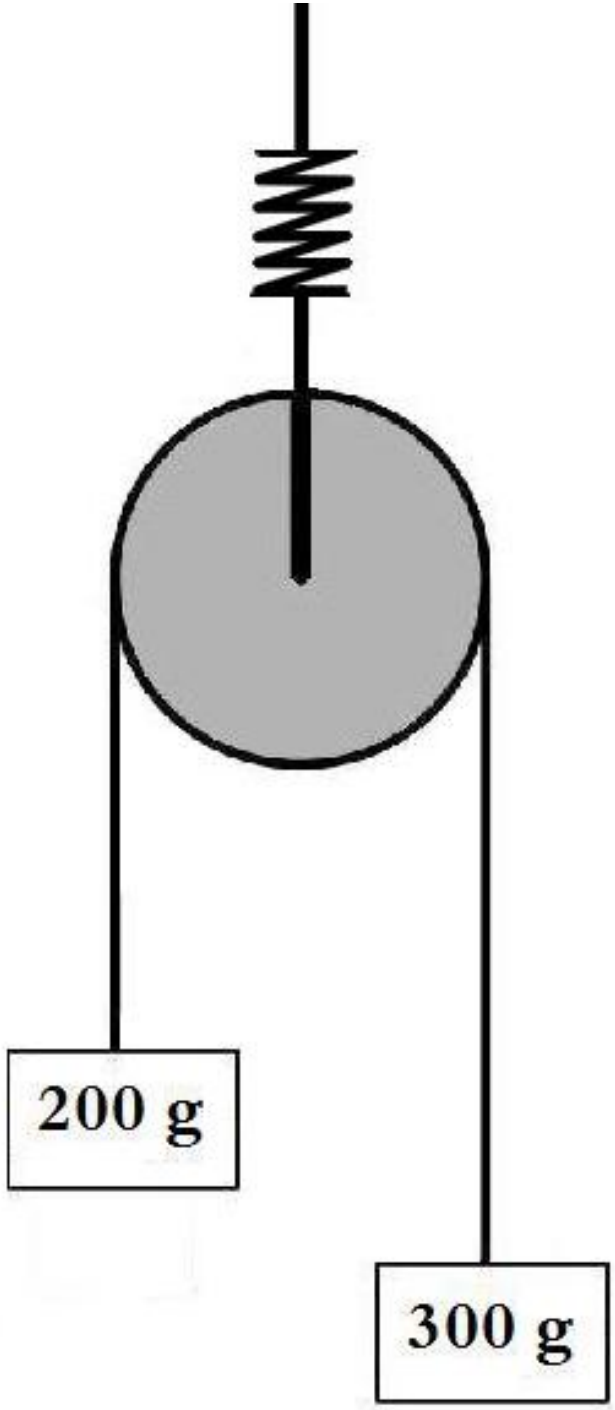


Peter and Neal Graneau



- ~~4.9~~ N
- 4.704 N



Thank you!