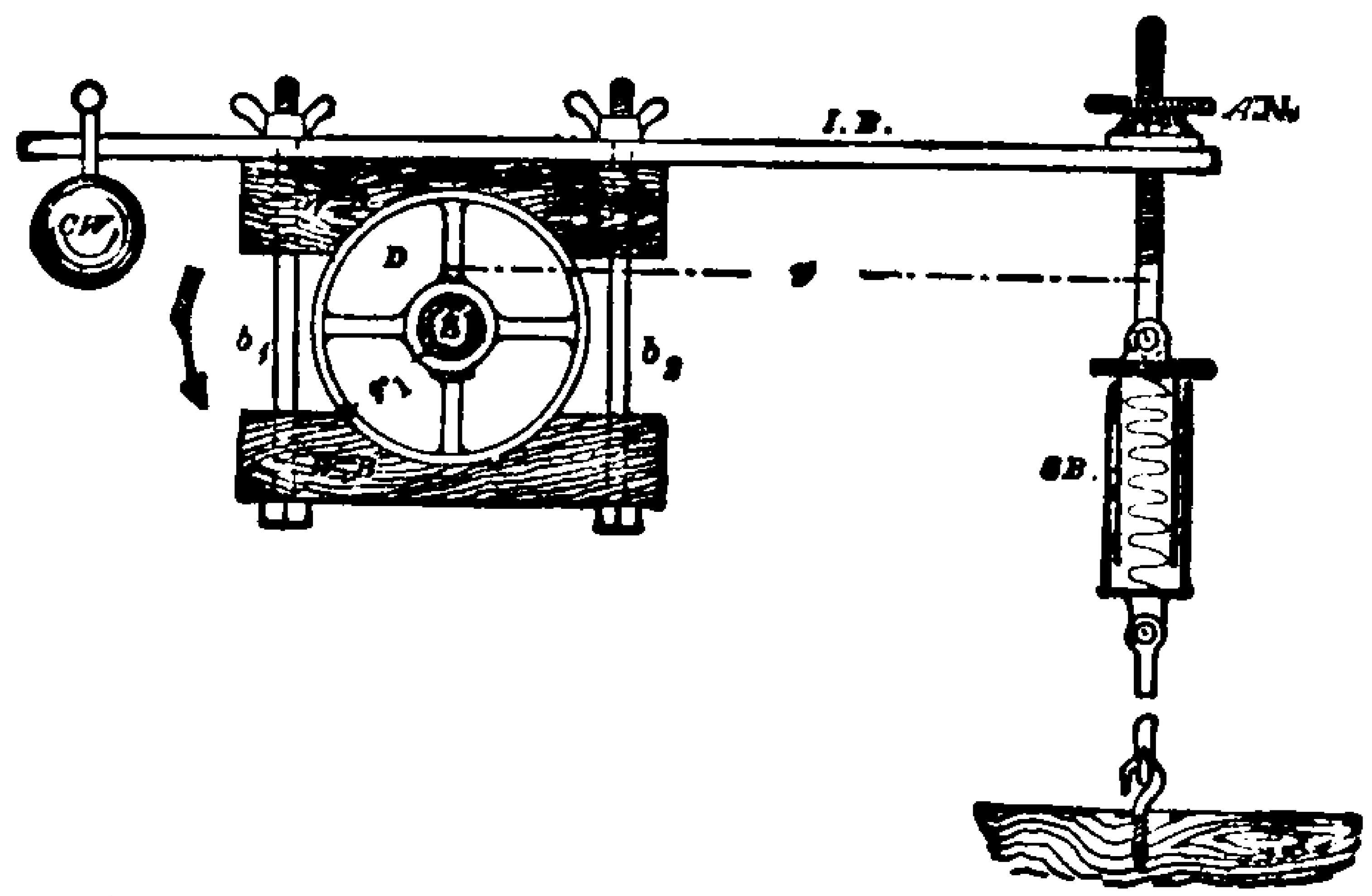
Brake Horse-power.—It is often advisable, more especially in the case of competitive trials of Land and Electric Light Engines, to know the actual power given out by an engine independent of the power absorbed in friction, &c., in driving the engine itself. In order to ascertain this, it is necessary either to apply an absorption or a transmission dynamometer to the fly-wheel, or to a pulley keyed on the crank or first shaft. The power so obtained, is termed the Brake Horse-Power and symbolised by the letters B.H.P.

It is certainly much more satisfactory to the buyer of an engine to know definitely the B.H.P. of an engine, than either the almost obsolete N.H.P., or the now more common I.H.P., for thereby he knows exactly what power he can get from the engine at a certain speed; and it would be well, both for buyers and sellers, if this system of reckoning the power of smaller engines was always insisted upon, and a test made before acceptance.

One of the simplest and most easily applied Absorption Dynamometers is that known as the Prony Brake, which we now illustrate and explain by an actual example of a test made by the author.

(The Student should also refer to the Author's *Text-Book of Applied Mechanics* for a more complete treatment of this subject.)



PRONY BRAKE OR ABSORPTION DYNAMOMETER.

Where W B	represents	Wooden blocks to fit.
D	,,	Drum or pulley keyed to
S	,,	Driving shaft.
$b_1\,b_2$	,,	Iron bolts with ram's horn nuts to adjust the tightness of W B on D.
I B	,,	Stiff iron bar with
S B	,,	Salter's balance at one end, and
C W	,,	Small counter weight to balance extra length of I B and S B on other side.
A N	,,	Adjusting nut for Salter's balance.

METHOD OF TAKING TEST FOR BRAKE HORSE-POWER.

1. Adjust position of C W until it balances the weight of I B, A N, and S B, with the wooden blocks slack on pulley.
2. Start machinery and tighten blocks, W B, by ram nuts until desired speed is attained, at same time adjusting S B by nut, A N, until a balance is obtained, keeping I B level.

Note number of revolutions per minute by speed indicator and stress indicated by spring balance.

$$\text{H.P.} = \frac{2\,\pi\, r\, n\, P}{33000} \text{ horse-power developed on brake.}$$

Where r = horizontal distance from centre of balance to centre of shaft S in feet.
n = number of revolutions per minute.
P = Salter's balance reading.

$$\text{Since } \frac{2\pi}{33000} = \cdot0001904 = \text{a constant.}$$

$$\text{H.P.} = \cdot0001904 \times r \times n \times \text{P}.$$

Ex.—Test recently taken by the author of fast-speed Westinghouse engine (diameter of cylinder 7-inch, stroke 5-inch, pressure of steam 55 lbs.), with crank shaft coupled direct to an Edison dynamo.

The blocks, W B, were fixed to a fly-wheel of 2 feet diameter, which was 6 inches broad.

$$r = 2\cdot5 \text{ feet}; \; n = 624; \; \text{P} = 48 \text{ lbs.}$$

$$\therefore \text{H.P.} = \cdot0001904 \times r \times n \times \text{P}$$

$$\therefore \text{H.P.} = \cdot0001904 \times 2\cdot5 \times 624 \times 48$$

$$\therefore \text{H.P.} = 14\cdot26.$$

It is important to note that neither the diameter of the pulley nor the pressure of the friction blocks on the same (due to the weight of the apparatus, or the tightening of the ram nuts), nor the coefficient of friction enter into the formula for obtaining the horse-power. The only data required being the horizontal length of lever, r, the pull, P, and the number of revolutions.

For, let, p, be the pressure, and, f, the coefficient of friction between the face of the drum, D, and two brake blocks, W B, then the twisting moment, T, tending to turn the brake blocks round with the shaft is

$$\text{T} = 2\,p\,f \times r_1$$

Where r_1 is the radius of the pulley or drum, D, in feet.