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On the Power of Machines

From the 1770s onwards, John Banks (1740–1805) taught natural philosophy and gave courses of public lectures across the north west of England. Much of his work aimed to show engineers, mechanics and artisans how they could benefit from expanding their practical and theoretical knowledge. In this 1803 publication, Banks ranges across mechanics, hydraulics and the strength of materials. He considers various designs for important industrial machines, such as watermills, pumps and steam engines, offering calculations of their power. Drawing on his own experiments, as well as those of others, he shows readers how to estimate the strength of wooden and iron beams, and how to calculate the airflow from a pair of bellows. Diverse in its topics, the book sheds light on how rational calculation came to be applied to the machinery of the industrial revolution. Banks' *Treatise on Mills* (2nd edition, 1815) is also reissued in this series.

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On the Power of Machines

JOHN BANKS

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University Printing House, Cambridge, CB2 8BS, United Kingdom

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www.cambridge.org
Information on this title: www.cambridge.org/9781108070270

This edition first published 1803
This digitally printed version 2014

ISBN 978-1-108-07027-0 Paperback

ON THE

POWER OF MACHINES,

ETC.

INCLUDING

DOCTOR BARKER'S MILL, WESTGARTH'S ENGINE,
COOPER'S MILL, HORIZONTAL WATER-WHEEL,
CENTRIFUGAL PUMP, COMMON PUMP, ETC.,

WITH THE METHOD OF COMPUTING THEIR FORCE.

DESCRIPTION

OF

A SIMPLE INSTRUMENT FOR MEASURING THE VELOCITY
OF AIR OUT OF BELLOWS, WHATEVER
BE THE PRESSURE.

ALSO OF

A GAUGE FOR MEASURING WITH ACCURACY THE
RAREFACTION IN THE CYLINDER OF
A STEAM ENGINE

DEMONSTRATION OF A PARALLEL MOTION.

OBSERVATIONS

ON

WHEEL CARRIAGES, ON LATHES, ON THE LEVER, ETC.

CONSTRUCTION OF A CRANK,

WHICH WILL ACT OR BE ACTED UPON NEARLY WITH THE SAME FORCE
IN EVERY PART OF A REVOLUTION, EXCEPT TOP AND BOTTOM.

EXPERIMENTS

ON

THE STRENGTH OF OAK, FIR, AND CAST IRON;

WITH MANY OBSERVATIONS RESPECTING THE FORM AND
DIMENSIONS OF BEAMS FOR STEAM ENGINES, ETC.

By JOHN BANKS,

LECTURER ON PHILOSOPHY.

Kendal:

PRINTED BY W. PENNINGTON;

AND SOLD BY W. J. AND J. RICHARDSON, LONDON.

1803.

PREFACE.

SOME of the machines introduced into the following work have been much extolled by different writers, who, at the ſame time, have given us no reaſon why they ought to be recommended; as they have not given us any juſt rules whereby to compute their force.

By the following work it appears that *Weſtgarth's Machine*, the *Centrifugal Machine*, and Dr. Barker's Mill, come far ſhort of the powers which ſome have aſcribed to them, as alſo the Old Mill at Nuneaton, ſo much applauded. It will readily be granted that the three firſt are ingenious inventions, and may in certain ſituations be uſeful, as any other machines, eſpecially the *Centrifugal Pump*: the advantage of which conſiſts

ſiſts in its having the water conſtantly riſing, or a continued ſtream aſcending while it is continued in motion, ſo that, different from a piſton pump, the *vis inertia* of the column of water is not to put in motion at every ſtroke.

Dr. Barker's mill cannot be recommended in practice, for, though it is preferable to an underſhot wheel, it cannot well be applied where there is a larger ſtream, as the other generally is, and if the ſtream is ſmall, an overſhot may be applied to much greater advantage. If there is little work to be done, and a ſufficient quantity of water, it, no doubt, may be recommended on account of the eaſy expence at which it is erected, compared with a bucket wheel.

The reader will obſerve that I have made many experiments on this mill, but have ſtill left the theory imperfect. What I have done may poſſibly be of ſome uſe to the next who may turn his attention to it.

The problem concerning the Lathe is accurate, but not by any means what I could wiſh. Some perſon better acquainted with ſcience may perhaps give a much ſhorter and ſimpler ſolution, but it is the beſt I could give.

The

The experiments on the velocity of air, for any thing I know, are new, as alſo the application of the inſtrument for meaſuring the velocity with which it iſſues out of bellows. The application of the ſteam gauge I preſume is new alſo. The experiments on the ſtrength of wood and caſt iron I hope will be found uſeful, eſpecially in their application to beams for different purpoſes; I would gladly have added many more, but circumſtances would not permit. Some gentlemen of fortune and ingenuity may perhaps continue them for their own and the public good.

I beg leave to obſerve to my reader, that if the work was to be reprinted it might be put in a better form, but at preſent I muſt ſubmit it to his candour. The figures in the plates were engraved, but not numbered till the engraver had a printed copy of the work, hence, the numbers in the different plates do not ſucceed in a regular manner, but as they are right numbered they will eaſily be found; only fig. 5, of which there are two, both belonging to Weſtgarth's engine, one in plate 1, the other in plate 3.

ERRATA.

ERRATA.

Page 20, *read* Fig. 5, plate 1 & 3; *p.* 49, *l.* 5, *for qs r.* *po*; *p.* 56, *the following table or scheme is omitted*

CD.	X.	CE.
$r = .5$	.369	.869
$r = .6$	.312	.912
$r = .7$	.254	.954
$r = .8$	.194	.994
$r = .9$	.133	1.033

p. 63, *l.* 6, *for* CE *r.* CC; *l.* 8, *for* CDE *r.* CDr; *p.* 92, *l.* 11, *for* plate 4 *r.* plate 3; *p.* 104, *l.* 10, *for* axles *r.* axle.

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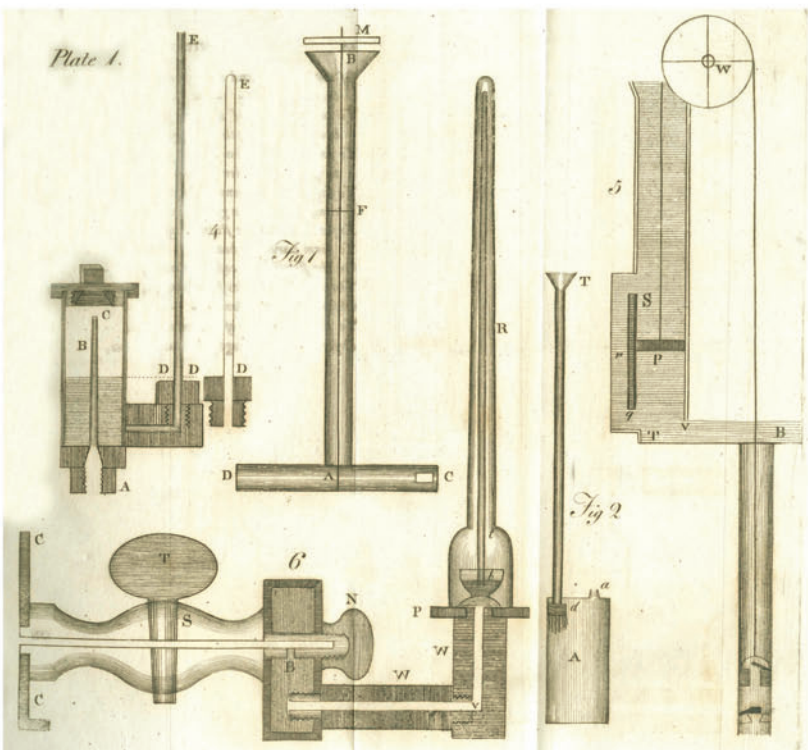

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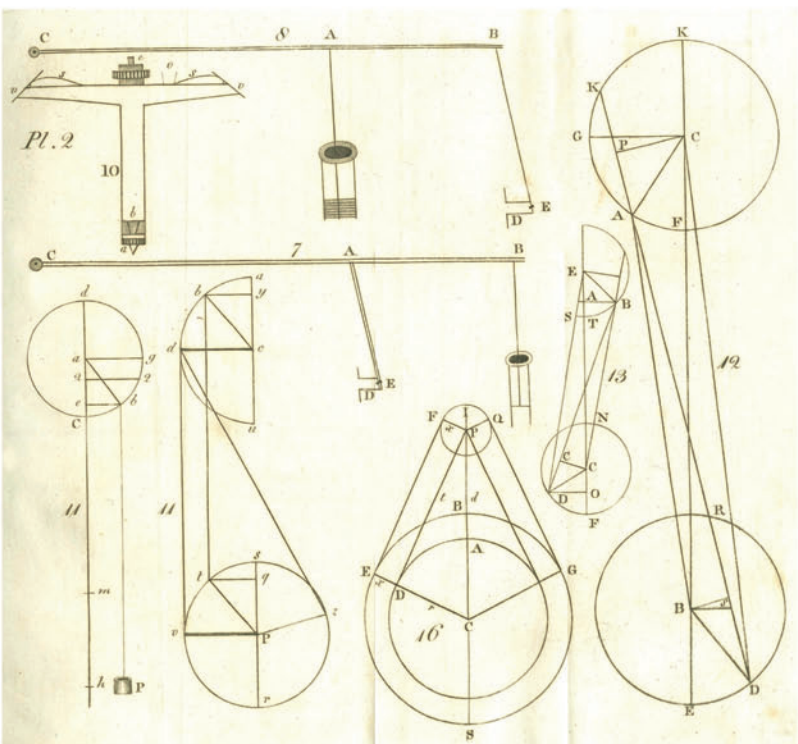

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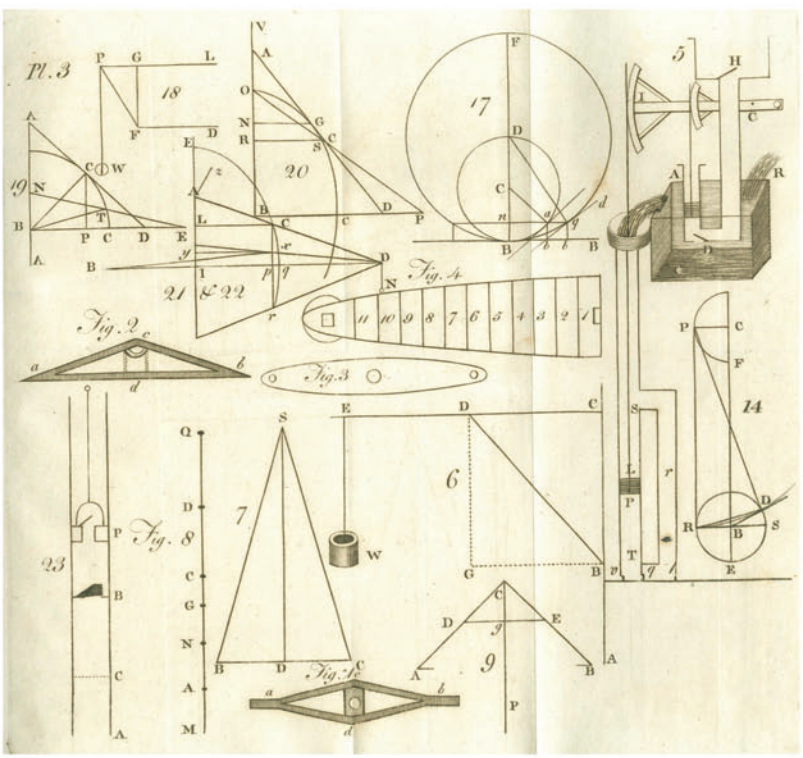

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