Chapter 1 : Heron's Inventions includes Holy Water Dispenser and the Aeolipile

the pneumatics. of. hero of alexandria. from the original greek. translated for and edited by. bennet woodcroft professor of machinery in university college, london.

Hero or Heron of Alexandria is a name under which a number of works have come down to us. They were written in Greek; but one of them, the Mechanics, is found only in an Arabic translation and another, the Optics, only in Latin. Apart from his works we know nothing at all about him. His name is not mentioned in any literary source earlier than Pappus a. Scholars have given different dates, ranging from b. Neugebauer, who observed that an eclipse of the moon described by Hero in his Dioptra chapter 35 as taking place on the tenth day before the vernal equinox and beginning at Alexandria in the fifth watch of the night, corresponds lo an eclipse in a. The rather minute theoretical possibility that Hero might have lived long after this date I have discussed and dismissed, while I have elsewhere reviewed the whole controversy about his dates, which is now of historical interest only. Diels found that he was a mere artisan. Hammer-Jensen took him to be an ignorant man who copied the chapters of his Pneumatics from works which he did not understand. Hoppe attempted to defend Hero. This view, which has been challenged in vain, was first put forth by H. The contents are almost exclusively apparatuses for parlor magic, and there is no discernible plan in the arrangement of the chapters. Apart from the introduction, there is no theoretical matter in the book, which consists entirely of practical descriptions. But since then, the Mechanics has been published in Arabic, and a manuscript has come to light giving the Metrica in its original form; thus the image of Hero has changed. The Mechanics shows nothing of the disorder of the Pneumatics, consisting of an introduction, a theoretical part, and a practical part; the Metrica shows that Hero possessed all the mathematical knowledge of his time, while a chapter of the Dioptra indicates that he was familiar with astronomy. We also find that he quotes Archimedes by preference and has copied many chapters of a lost work of his on the statics of plane figures. In the introduction to the Pneumatics, Diels found a quotation from Strato of Lampsacus fl. The form of this theoretical introduction led I. Hammer-Jensen to assume that Hero was an ignoramus who did not understand what he copied from diverse sources; yet to me the freely flowing, rather discursive style suggests a man well-versed in his subject who is giving a quick summary to an audience that knows, or who might be expected to know, a good deal about it. Since we know the author as Hero of Alexandria, it seems reasonable to assume that he was appointed to the museum, that is, the University of Alexandria, where he taught mathematics, physics, pneumatics, and mechanics, and wrote textbooks on these subjects. The Pneumatics can best be regarded as a collection of notes for such a textbook, of which only the introduction and the first six chapters have been given their final shape. All the chapters are uniform in style, even those taken from Philo, and eminently clear, so the idea of an ignorant compiler cannot be upheld. But there is more to be learned from the Pneumatics. While there is no order at all in the general arrangement of the chapters, we find here and there a short series of related chapters in which it is clear that Hero is searching for a better solution to a mechanical problem. This shows unmistakably that he was an inventor; it is therefore probable that he himself invented the dioptra, the screw-cutter, and the odometer, as well as several pneumatic apparatuses. This is all that can be learned about Hero himself. The following works have survived under the name of Hero: These can be divided into two categories, technical and mathematical. All the technical books, except the Cheirobalistra, seem to have been written by Hero; of the mathematical books only the Definitiones and the Metrica are direct from his hand. The others are, according to J. Heiberg, Byzantine schoolbooks with so many additions that it is impossible to know what is genuinely Heronian and what is not. Only the introduction and the first six or seven chapters are finished. The introduction treats the occurrence of a vacuum in nature and the pressure of air and water; although it is written in a very prolix style with occasional digressions, the train of thought is never lost. It seems to have been written by a man very well versed in his subject, who is summarizing for students of pneumatics matters already known to them from their textbooks. Some of the theory is right, some is wrong for instance, the horror vacui of nature , but it was the best theoretical explanation to be had at the time; a real understanding of the phenomenon had to wait for the experiments of Torricelli. Hero goes on to siphons; but

soon all order is lost, and the chapters appear haphazardly. Yet there is nothing haphazard about the chapters themselves, each of whichâ€”whether taken from Philo or a description of an apparatus seen by Heroâ€”is written in the same concise style and according to a fixed plan, beginning with a description of the apparatus, with letters referring to a figure, then a description of how it works, then last if necessary an explanation. With very few exceptions it is evident that the chapters were written by Hero himself, and without exception they are very clear: The contents, on the other hand, have always been a source of puzzlement and despair for serious-minded scholars. Certainly Hero describes some useful implementsâ€”a fire pump and a water organâ€”but all the rest are playthings, puppet shows, or apparatuses for parlor magic. Trick jars that give out wine or water separately or in constant proportions, singing birds and sounding trumpets, puppets that move when a fire is lit on an altar, animals that drink when they are offered waterâ€”how can one respect an author who takes all these frivolities in earnest? In I explained this by the assumption that he was writing a handbook for the makers of pneumatic instruments, but this is not necessarily correct. The book is a text for students, and Hero describes instruments the student needs to know, just as a modern physics textbook explains the laws governing the spinning top or the climbing monkey. Playthings take up so much of the book because such toys were very much in vogue at the time and the science of pneumatics was used for very little else. Among the many toys of the Pneumatics there are even a few that use hot air or steam as a moving power, which has given rise to ill-founded speculations that the steam engine could have been invented at this time. To this we must add that Hero was an inventor; and to a real inventor any clever apparatus is of interest, regardless of its purpose. There is a slightly different text, found only in four manuscripts, that is generally designated Pseudo-Hero. This text cannot have been written later than a. The Mechanics, preserved only in an Arabic version, was published in with a French translation and in with a German translation. A textbook for architects that is, engineers, builders, and contractors , it is divided into three books. Book 1 deals with the theoretical knowledge and the practical skill necessary for the architect: Drawing largely upon Archimedes, Hero then presents the theory of the center of gravity and equilibrium, the statics of a horizontal beam resting on vertical posts, and the theory of the balance. Book 3 describes sledges for transporting burdens on land, cranes and their accessories, other devices for transport, and wine presses: Apart from the first chapter of book 1, which contains the Barulkos, the work proceeds in an orderly fashion; it shows nothing of the disorder of the Pneumatics, but the style is equally clear and concise, with a single exception. In book 1, chapter 24, Hero gives the theory of the center of gravity, and there he uses the same prolix and discursive style as in the introduction to the Pneumatics. This chapter would also seem to be a summary for students who should already know the subject. There are figures for most of the chapters; that they go back to the original Greek text can be seen from a mistake in the translation of a Greek work in one of the figures. The description, which unfortunately is imperfect owing to a lacuna in the manuscript, covers six chapters; chapters 7â€”32 contain directions for the use of the two instruments in a great number of tasks. In chapter 33 Hero criticizes the groma, the instrument then used for staking out lines at right angles; chapter 34 describes an odometer actuated by the wheel of a car, used for measuring distances by driving slowly along a level road. Chapter 35 indicates the method for finding the distance between Alexandria and Rome by simultaneously observing a lunar eclipse in the two cities; this chapter has been thoroughly studied by O. The catapults are shaped like those described by Vitruvius and Philo. The former moves before the audience by itself and shows a temple in which a fire is lit on an altar and the god Dionysus pours out a libation while bacchantes dance about him to the sound of trumpets and drums. After the performance the theater withdraws. The stationary theater opens and shuts its doors on the performance of the myth of Nauplius. The shipwrights work; the ships are launched and cross a sea in which dolphins leap; Nauplius lights the false beacon to lead them astray; the ship is wrecked; and Athena destroys the defiant Ajax with thunder and lightning. The driving power in both cases was a heavy lead weight resting on a heap of millet grains which escaped through a hole. The weight was attached by a rope to an axle, and the turning of this axle brought about all the movements by means of strings and drums. Strings and drums constituted practically all the machinery; no springs or cogwheels were used. It represents a marvel of ingenuity with very scant mechanical means. The Catoptrica, found only in a Latin version, was formerly ascribed to Ptolemy, but is now generally accepted as by Hero. It deals with mirrors,

both plane and curved, and gives the theory of reflection; it also contains instructions on how to make mirrors for different purposes and how to arrange them for illusions. The engine consists of parallel toothed wheels and is derived from the Mechanics, book 1, chapter 21; however, it is only a theoretical solution: Marsden has interpreted these chapters s a description of a sort of catapult, which he has reconstructed. Pappus of Alexandria, Collectionis quae supersunt Drachmann, Ktesibios, Philon and Heron, vol. IV of Acta historica Scientiarum naturalium et medicinalium Copenhagen, , pp. Preussischen Akademie der Wissenschaften zu Berlin, no. Drachmann, The Mechanical Technology Vitruvius, De architectura, X, ch. Hero, Mechanics, introduction, pp. Marsden, Greek and Roman Artillery. Technical Treatises Oxford, , pp. Heronis Alexandrini Opera quae supersunt omnia, 5 vols. Automata is published with Pneumatica, Opera, 1. Preussischen Akademie der Wissenschaften, Phil. Greek and Roman Artillery. Technical Treatises Oxford, , with English trans, and notes. Catoptrica is published with Mechanica, Opera, II, pt. Definitiones and Geometrica appear as Heronis definitiones cum variis collectionibus Heronis quae feruntur Geometrica, J. Schmidt, Opera, II, pt. De mensuris is published with Stereometrica, Opera, V. Metrica is available in three versions: Codex Constantinopolitanus Palatii Veteris, no. Stereometrica appears as Heronis quae feruntur Stereometrica et De mensuris, J. Drachmann Pick a style below, and copy the text for your bibliography.

Chapter 2 : Catalog Record: The Pneumatics of Hero of Alexandria, from | Hathi Trust Digital Library

Hero (or Heron) of Alexandria (c. AD) was an ancient Greek mathematician and engineer who was active in his native city of Alexandria, Roman Egypt. He is considered the greatest experimenter of antiquity and his work is representative of the Hellenistic scientific tradition.

He invented several sophisticated machines which demonstrate his vast knowledge in mechanics. Hero also called Heron, was a Greek mathematician. The date of his birth remains uncertain. Other scholars date his birth to be CE in late Roman Empire. As a student, Hero spent most of his time in the Library at the University of Alexandria. He loved to be in the library, because of the series of gardens vast collection of books. Hero was strongly influenced by the writings of Ctesibius of Alexandria. It is possible he was a student of Ctesibius. When older he taught at the University of Alexandria, and taught mathematics, mechanics, and physical science. He wrote many books and he used them as texts for his students, and manuals for technicians, and were written in Greek, Latin and Egyptian. It consisted of an airtight vase of water which, at the top, had a tubular opening where water entered and reached the bottom and of an airtight vase of wine which, in the middle, had a tap in a siphon shape. The two vases were connected by an intermediate small tube that entered the bottom and reached close to their top. When a certain amount of water was poured into the first vase, the air inside went through the intermediate tube to the second vase pushing out the equal amount of wine. Hero is credited with authorship of several manuscripts including Automata, theP neumatica, the Dioptra, the Catoprica and the Mechanica. Hero invented a number of fascinating machines. Standing on the shoulders of giants, it is believed that Hero studied the works of Archimedes and Vitruvius, as well as Ctesibius. Hero of Alexandria spent many hours in the library. However, today it is very difficult to determine which invention was his. He invented a rocket-like device called an aeolipile. It used steam for propulsion. Hero mounted a sphere on top of a water kettle. A fire below the kettle turned the water into steam, and the gas traveled through the pipes to the sphere. Two L-shaped tubes on opposite sides of the sphere allowed the gas to escape, and in doing so gave a thrust to the sphere that caused it to rotate. Below is just a selection of some of the machines he invented. Unlike his steam engine this invention did not require any great technical prowess or mechanical plays, but it did apparently require his unique insight. It should be added that there are not any records of wind-powered machines before Hero came along. These vending machines allowed each member to receive an equal allotment of holy water without requiring the presence of the priest. When a coin was placed in the slot of the vending machine, it would rest on a platform. The weight of the coin would push the platform down, opening a valve and dispensing a consistent trickle of holy water. To open the doors, the priest lit a fire on the altar, heating the air within and causing it to expand. This expansion in volume forced water out of the sphere and into the bucket, which moved downwards under the extra weight. This bucket was connected to a rope coiled around a spindle and, as the bucket moved downwards, this spindle revolved, making the doors open.

Chapter 3 : The Pneumatics by Hero of Alexandria - Engineering History - Eng-Tips

2nd EDITION Hero (or Heron) of Alexandria (c. AD) was an ancient Greek mathematician and engineer who lived in the Roman province of Egypt; He is considered the greatest experimenter of antiquity and his work is representative of the Greek scientific tradition.

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An Automaton the head of which continues attached to the body after a knife has entered the neck at one side passed completely through it and out a.

Chapter 5 : Home - Sigma Pneumatics, Inc.

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Hero (or Heron) of Alexandria (c. AD) was an ancient Greek mathematician and engineer who was active in his native city of Alexandria during the height of the Roman Empire. He is considered the greatest experimenter of antiquity and his work is representative of the Hellenistic scientific tradition.

Chapter 6 : Hero of Alexandria â€“ IIHR â€“ Hydroscience & Engineering

Life and career. Hero may have been either a Greek or a Hellenized Egyptian. It is almost certain that Hero taught at the Musaeum which included the famous Library of Alexandria, because most of his writings appear as lecture notes for courses in mathematics, mechanics, physics, and pneumatics.

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Hero of Alexandria (calendrierdelascience.comdria, a.d. 62) mathematics, physics, pneumatics, mechanics.. Hero (or Heron) of Alexandria is a name under which a number of works have come down to us.

Chapter 9 : THE PNEUMATICS OF HERO OF ALEXANDRIA

Extra resources for The pneumatics of Hero of Alexandria Example text It is necessary however that the least of the balls when placed in the cup should preponderate over the weight K', or, in other words, be able to cause E' F' to revolve; for then the other balls will preponderate and move E' F'.