THE INVENTIONS OF ARCHIMEDES.

The ancients attribute to Archimedes more than forty mechanical inventions—among which are the endless screw; the combination of pulleys; an hydraulic organ, according to Tertullian; a machine called the *heliz*, or screw, for launching ships; and a machine called *loculus*, which appears to have consisted of forty pieces, by the putting together of which various objects could be framed, and which was used by boys as a sort of artificial memory.

Archimedes is said to have obtained the friendship and confidence of Hiero by the following incident. The king had delivered a certain weight of gold to a workman to be made into a crown. When the crown was made and sent to the king, a suspicion arose in the royal mind that the gold had been adulterated by the alloy of a baser metal, and he applied to Archimedes for his assistance in detecting the imposture : the difficulty was to measure the bulk of the crown without melting it into a regular figure; for sliver being, weight for weight, of greater bulk than gold, any alloy of the former in place of an equal weight of the latter would necessarily increase the bulk of the crown; and at that time there was no known means of testing the purity of metal. Archimedes, after many unsuccessful attempts, was about to abandon the object altogether, when the following circumstance suggested to his discerning and prepared mind a train of thought which led to the solution of the difficulty. Stepping into his bath one day, as was his custom, his mind doubtless fixed on the object of his research, he chanced to observe that, the bath being full, a quantity of water of the same bulk as his body must flow over before he could immerse himself. He probably perceived that any other body of the same bulk would have raised the water equally : but that another body of the same weight, but less bulky, would not have produced so great an effect. In the words of Vitruvius, 'as soon as he had hit upon this method of detection, he did not wait a moment, but jumped joyfully out of the bath, and running forthwith towards his own house, called out with a loud voice that he had found what he sought. For as he ran he called out, in Greek, Eurekal Eurekal 'I have found it out! I have found it out!' When his emotion had sobered down, he proceeded to investigate the subject calmly. He procured two masses of metal, each of equal weight with the crown-one of gold, and the other of silver; and having filied a vessel very accurately with water, he plunged into it the silver, and marked the exact quantity of water that overflowed. He then treated the gold in the same manner, and observed that a less quantity of water overflowed than before. He next plunged the crown into the same vessel full of water, and observed that it

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