

before the Christian era, as illustrated in the use of the siphon and the atmospheric watering pots of the early Egyptians. Though the principle of the perfect vacuum is undoubtedly due to Torricelli, by his production of the mercurial vacuum about 1643 A.D., then its principles slumbered in its low pressure use for more than a thousand years, when the arrow discharged under air pressure by Cteribius, finally developed into the pneumatic gun of Maxim, in France, which was presented to Henry IV in 1600.

The water Trombe, or Tromp, for compressing air by a fall of water in a tube, used for blowing forges and other purposes, was known to Heron, and was mentioned by Pliny in his Natural History.

The principle of Heron's pneumatic fountain for raising water was carried out on a large and useful scale in the pneumatic pumping engine at the mines of Chemnitz, in Hungary, in 1755, which was erected by M. Hoell. There was probably first illustrated the refrigerating power of air when expanded from great pressures. In the lower chamber of this apparatus the discharge and its expansion with water produced pellets of ice.

The use of compressed air for submarine work was no doubt well known in the earliest ages. Aristotle, 350 B.C., describes a kettle in which divers supplied themselves with fresh air under water. The legend of the descension of Alexander the Great, to the bottom of the sea, in a vessel called a Cotympia with a glass window in it, is no doubt an allusion to the use of the diving bell. It was employed in Phonicica in the 320 B.C., and the use of glass was well known then.

Nothing further appears on record in regard to submarine work with a bell for more than fifteen hundred years, when mention of its use in Spain in 1538 is met with. Bacon describes it, in 1620, as a machine used to assist persons labouring under water upon wrecks, affording a reservoir of air into which they could take breath.

In 1715 Dr. Halley made the first contrivance for supplying the diving bell with fresh air by lowering air-filled barrels and discharging the air under the bell, letting out the foul air at the top through a cock, or of allowing of completely filling the space with air that was made unavailable heretofore, by the compression of air in the bell.

Dr. Halley suggested the present system of submarine armour by using a cap or portable helmet connected with a tube leading to the surface, through which fresh air was forced to the helmet for the needs of the diver.

Smeaton and Burnell, from 1779 on, improved on the use of the diving bell, making its operation continuous by a fresh supply of compressed air through tubes from pumps.