XI. Description of an air and a water-vault employed to equalize the discharge of air into a blast-furnace

Mr. David Mushet

To cite this article: Mr. David Mushet (1800) XI. Description of an air and a water-vault employed to equalize the discharge of air into a blast-furnace , Philosophical Magazine Series 1, 6:24, 362-364, DOI: [10.1080/14786440008677237](https://doi.org/10.1080/14786440008677237)

To link to this article: <http://dx.doi.org/10.1080/14786440008677237>

Published online: 25 Jan 2010.

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one of the most essential parts has been taken away. Now such fossil or burned bones can no more be regarded as bone, than charcoal can be considered as the vegetable of which it retains the figure and fibrous structure.

Bones which keep their figure after combustion resemble charcoal made from vegetables replete with fibre; and cartilaginous bones which lose their shape by the same cause may be compared to succulent plants, which are reduced in bulk and shape in a similar manner.

From these last experiments I much question if bodies consisting of phosphat of lime, like bones, have concurred materially to form strata of limestone or chalk; for it appears to be improbable that phosphat is converted into carbonat of lime after these bodies have become extraneous fossils.

The destruction or decomposition of the cartilaginous parts of teeth and bones in a fossil state must have been the work of a very long period of time, unless accelerated by the action of some mineral principle; for, after having, in the usual manner, steeped in muriatic acid the os humeri of a man brought from Hythe in Kent, and said to have been taken from a Saxon tomb, I found the remaining cartilage nearly as complete as that of a recent bone. The difficult destructibility of substances of a somewhat similar nature appears also from the piercing implements formed of horn, which are not unfrequently found in excavations of high antiquity.

XI. Description of an Air and a Water-Vault employed to equalize the discharge of Air into a Blast-Furnace. By Mr. DAVID MUSHET.

FIG. 1. (Plate XI.) represents a vertical section of the elevation of an air-vault 60 feet long and 30 feet wide, consisting of four arches of regularly progressive sizes. This building is generally constructed under the bridgehouse, where the materials are daily collected for filling the furnace. AB, represents the acclivity to the furnace top. The space betwixt the arch-tops and the level of the floor is filled with materials as dense as can be procured. The walls of the under
part

Fig. 2.

Fig. 1.

Fig. 4.

Fig. 3.

50

part are three feet thick, besides a lining of brick and plaster from 18 inches to two feet. Still further precautions are necessary, and alternate layers of pitch and stout paper are requisite to prevent the escape of the compressed air. C, a view of the arched funnel which conveys the air from the cylinder to the vault. Large iron pipes with a well fitted door are preferable, and less apt to emit air. D, an end view of the pipe by which the blast is carried to the furnace.

Fig. 2. is a horizontal section of Fig. 1. at the dotted line *ab*, representing the width of the cross arches, which are thrown in each partition to preserve an easy communication betwixt the vaults. D, is a section of the first range of pipes, meant to conduct the air to the furnace. In like manner pipes may be taken off from any part of the vault for the different purposes of blowing furnaces, fineries, hollow fires, &c.

Fig. 3. represents a vertical longitudinal section of what is generally called the water-vault. The walls of this building may be erected to the height of eight or nine feet, their thickness similar to those of the air-vault. A brick lining, and even puddling with clay betwixt it and the stone building, is necessary to prevent the water from oozing by the accumulated pressure. A, is an end view of the horizontal range of pipes which conveys the blast from the blowing cylinder to the inverted chest. BBB, the range which conducts the air to the interior of the inverted chest, and conveys it to the furnaces, proceeding along the extremities of the columns broken off at BB. C, an inverted chest made of wood, iron, or even of well-hewn flags set on end and tightly cemented, is 54 feet within in length, 18 feet wide, and 12 feet high. The dimensions, however, vary at different works. When the chest is made of wood or iron, it is generally bolted by means of a flange to the logs on which it is supported, lest the great pressure of air should overcome the gravitation of the chest, and displace it. DD, view of the centre log, and ends of the cross logs, on which the chest is laid. These should measure 18 inches in height, so as that the mouth of the chest may be that distance from the surface of the floor, and the water allowed to retreat from the interior of the chest with the least possible obstruction. EE, the out-

side walls of the building. FF, the brick-work, made perfectly water tight. The dotted line G, represents the surface of the water when at rest. Let the depth of the water, outside and inside of the chest, be estimated at four feet. When the engine is at work, should the pressure of the air have forced the water down to the dotted line H, $3\frac{1}{2}$ feet distant from the line G, and only six inches from the mouth of the chest, it follows, that the water must have risen in the outer building, or chest, $3\frac{1}{2}$ feet above G, and have its highest surface nearly at rest at I. In this case the strength of the blast is reckoned equal to seven feet of water, or nearly six inches of mercury. The space betwixt the chest and outside building is three feet. When the engine is at rest, and the water has assumed its level, the quantity of water within the chest should be equal to that without.

Fig. 4. is a ground plan of Fig. 3. The cross logs on which the cistern is supported are dotted within, but drawn full in the space betwixt the flange of the chest and outer building. The breadth of the flange-tops of the binding bolts, and thickness of the metal of the chest, are also drawn. The letters bear a reference to those in No. 3.

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