

In last January's Labyrinth I wrote about Vitruvius, the architect-contemporary of Augustus. In the tenth book of Vitruvius' On Architecture, he describes a machine well-known to spectators at the public games and beast-shows for the musical interludes it helped to provide. Mosaics show us small orchestras or ensembles of trumpeters and hornplayers together with the hydraulus or water-organ. The organ was invented, Vitruvius informs his reader in Book IX, chapter 8, by Ctesibius of Alexandria, who was also responsible for the invention of many other ingenious devices such as water clocks and all kinds of automata or puppet-figures worked by air pressure or the controlled flow of water. Space does not permit me here to give a complete translation of Vitruvius' account of the water-organ, but you may be able to find it for yourself in Sections 1 to 5 of Book X, chapter 8. Since Vitruvius' description of the machine is not perfectly unambiguous, my drawing only provides one possible interpretation of it. Anyone who would like to take a shot at producing a (working) model of this hydraulus is warmly invited to contact me, as I'd love to know whether it could actually be constructed!

A few comments on the picture: the basic instrument consists of a box with pump-handles sticking out at the sides topped by a bank of organ pipes set above a keyboard. The organist depresses the keys while an assistant or two pump, and the organ plays--loudly, from what we can gather from ancient writers' complaints about the ear-splitting music enjoyed at breaks in the shows in the arena. Inside the box is a metal chest holding a reservoir of water, flanked by two cylinders containing pistons used to pump air into the air jar. The open neck of the air jar is connected with a wind chest which forms the base for the pipes and the keyboard. This particular organ is called a tetrachord because it has four banks of pipes. Each group of four pipes is closed off from the air in the wind chest by one of the sliders or plinthises. Each slider is connected to one of the keys by a metal spring. When the key is depressed by the player, the slider moves backwards, allowing holes in it to line up with openings above (in the pinax) and below (in the canon). This admits air through all three boards up into the pipe. Should the player want to use only one or two of the group of pipes, he can close off an entire channel by means of what Vitruvius calls an "iron stopcock". I haven't drawn one of these because I'm not sure where such a stopcock would be fitted, so that its handle is easily reached by the player--and Vitruvius doesn't say.

The valves which are used on the pipes entering the air jar are simple flap-valves, but those on the cylinders are more tricky. The dolphin is weighted so that the valve on a chain in its mouth is normally closed. Only when air is drawn forcibly in by the piston's downward movement will the valve be pulled down, to bob back into position again as the piston rises. The only purpose of the water, as far as I can see, is to even out the pressure between piston movements to ensure a steady air flow.