

Cartesian Divers

More Details

The crucial density

When you pump air into the water column, the tube and ball begin to sink. When the air slowly escapes, they rise again. Why is this so?

The pumping increases the pressure in the column. It compresses everything in it: the water, the ball, the tube and the air in the tube.

What happens to the ball is clear: it is so soft that the water can deform it. As a result, it becomes smaller, its density increases – it sinks. But the glass tube is not deformed – so what happens?

Because air can be compressed more easily than water or plastic (scientists say: a gas is more compressible than a liquid), the air bubble in the tube is heavily compressed. Water can flow into the tube, it gets heavier overall and begins to sink. When the pressure in the column decreases again, the air bubble in the tube expands and pushes the water that was previously pressed into it out again. The tube becomes lighter and rises to the top.

Can you see how the air bubble decreases, when you pump air into the water column, and how it increases, when the air slowly escapes.

Devil in a bottle...

Since the middle of the 17th century, when the Thirty Years' War ended in Central Europe, this kind of diver has existed. At that time, physics was more of an amusement, so the divers were made as little glass devils (Fig. 1).

Even today they are still made as toys. They work like our bottle: there is a hidden opening in the tip of the tail through which the water enters and comes out again. It points to the side, so the little devil can even do pirouettes while diving!



Fig. 1: Glass devil.

...or Cartesian diver

It was not until the 19th century that this marvellous thing was given the name Cartesian diver or Cartesian devil. The term contains a reference to René Descartes (1596-1650). But the great French all-rounder (mathematician, physicist and philosopher) had nothing to do with the little devil. The name was probably only intended to make the

product interesting for the educated classes of the time – a real labelling fraud!