Air pressure levitator

More Details

Our “air pressure miracle” is amazing and unexpected, but on closer inspection it is comprehensible and logical: The same amount of air always flows out of the tube. This amount of air must now pass through the slit between the Plexiglas and the disc. The smaller the slit, the faster the air must flow so that the same amount passes through. The following relationship applies to the flowing air: The sum of dynamic pressure (resulting from the flow with the velocity *v*) and static pressure *p* (which is the normal air pressure) always remains the same.

$$\frac{1}{2}\rho v^2 + p = const.$$

So if the velocity *v* and thus the dynamic pressure increases, the static pressure *p* must inevitably become smaller so that the sum remains unchanged. The pressure in the slit decreases, and the smaller the slit becomes, the more the pressure decreases. At some point, the pressure is so low compared to the normal air pressure under the disc that it can suck the disc in.

The Bernoulli principle, named after its discoverer, applies in principle to all flowing gases and liquids: the faster the flow, the lower the static pressure.

The mystery of flying

Bernoulli's principle is partly responsible for the fact that aircrafts can fly. The air flows faster along the upper side of the wing than along the lower side. As a result, the pressure on the lower side is greater and supports the aircraft.

But we do not know exactly why the air flows faster at the upper side than at the lower side. The widespread opinion that the uplift is caused by the fact that the distance travelled on the upper side is longer than on the lower side cannot be correct: The upper airflow cannot "know" that the lower airflow has a shorter path. So it has no reason to hurry.

The Bernoulli formula is not much help to aircraft manufacturers. The actual uplift of a wing can only be determined in the wind tunnel, i.e. by trial and error. Although there are now sophisticated computer programmes for calculating the complicated flow conditions, even they do not deliver exact results. Flying is probably one of those phenomena that we simply have to accept without being able to understand it down to the last detail.

So for the moment, aeronautical engineers, airlines and passengers must be satisfied with the fact that the aircraft flies – without knowing why.

An experiment for at home

You can try Bernoulli's principle at home: Hold a piece of paper with two fingers in front of your lips and blow on it. Contrary to what most people expect, the sheet moves upwards. The air flow creates a negative pressure on the upper side of the sheet and the air from below pushes the sheet upwards.

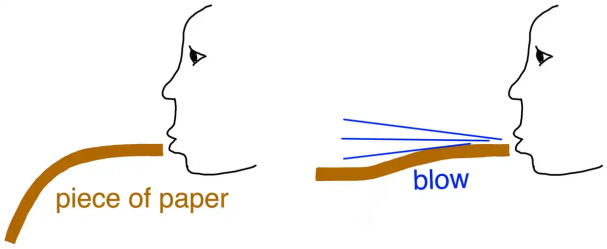

Fig. 1: Bernoulli experiment with a piece of paper.