Shut-off valve designed for the analysis of respiratory mechanics

Valve specifically designed to suddenly cut off respiratory flow using the interruption technique, which allows the measurement of fundamental parameters of respiratory mechanics. The design of the valve produces a very short closure time and a hermetic seal.

Description and essential characteristics

A shut-off valve specifically designed for the interruption technique—a technique based on the sudden interruption of inspiratory or expiratory flow, maintaining this interruption (zero flow) for some seconds. This technique is used in the analysis of respiratory mechanics, based on recording tracheal pressure and oesophageal pressure, and allows an accurate calculation of the fundamental parameters of the respiratory mechanics, such as the airway resistance, tissue strength and dynamic and static elasticity of the respiratory system.

The design consists of a cylindrical valve body (1) comprising two coaxial chambers: a high-pressure chamber (3) and a low-pressure chamber (4), inside which move corresponding pistons, (5) and (6), connected to each other by a common shaft (7).

The high-pressure chamber (3) is provided with an inlet (9) for connection to a high-pressure source, and the low-pressure chamber (4) is provided with an inlet (10) from the respirator and an outlet (11) with an orifice (12) to the patient, which are directly connected in an open-valve situation and hermetically sealed by the piston (6) of the low-pressure chamber (4) when the high-pressure chamber (3) is pressurised.

Upon receiving gas at a suitable pressure, the piston (5) in the high-pressure chamber (3) moves such as to pull the other piston (6) against a spring (8), thereby pulling the piston (6) placed between the inlet (10) for gas from the respirator and the gas outlet (11) to the patient, so as to provide a very short closure time as well as a hermetic closure during the interruption.

Competitive advantages

The interruption technique presents a pressure vs. time curve comprised of three phases:

(1) An initial brusque change in pressure (drops if the interruption is during inspiration and rises if it is during expiration).
(2) A high-frequency transitory oscillation.
(3) A slow change in pressure until reaching equilibrium.

This new valve design allows the correct determination of the start and end points of phases (1) and (3), essential for an accurate calculation of the parameters of respiratory mechanics, which is particularly difficult due to oscillations of the second phase.

An accurate determination of these points requires the valve to have a very short closure time and a hermetic seal during the time of the interruption; characteristics which are very difficult to attain, as they act in opposition. In other words, the smaller the resistance during closure (faster occlusion), the less hermetic the occlusion.

Type of collaboration sought

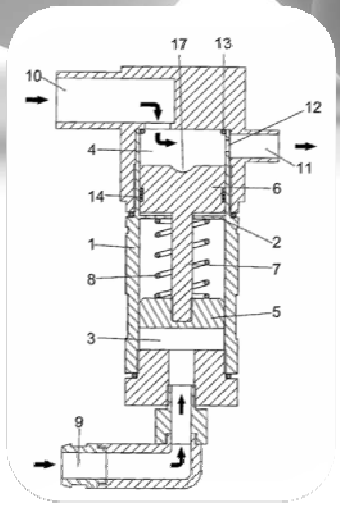
Cooperation is sought with any Party interested in partnering, licensing or investing in the technology, whether it be an investor to fund the project, a partner interested in getting involved in any of the various phases until its placement on the market, a patent licensee, etc. Organisations potentially interested in this technology are those devoted to the manufacture, commercialisation and/or distribution of healthcare products; as well as hospitals, healthcare centres, etc.

Current stage of development

R&D Phase

Current state of intellectual property

European patent 05750159.5, granted in March 2012.
International patent application PCT/ES2005/000271.



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