Milestones in intensive care ventilation
From a wooden case to a digital assistant

More than 100 years have passed between the world's first mechanical emergency ventilator going into production and today's intensive care ventilator with microelectronic control. Ventilation that is easy on the lungs, the possibility of spontaneous respiration at any time, monitoring of breathing air distribution in the lungs at the patient's bed - medics were nowhere near having these options at their disposal at the start of the 20th century.

At the same time, the basic principle of ventilation has not changed: Mechanical breathing strokes in the lungs trigger an increase in pressure. The pressure then falls again during passive exhalation. The ventilation device takes care of the exchange of gases in the lungs.

The origins of mechanical ventilation
- **1907 – Dräger Pulmotor**
  Johann Heinrich Dräger designs a ventilator, which can immediately provide oxygen for emergency ventilation. This makes it possible to resuscitate people who, for example, have become unconscious due to a lack of oxygen. The Pulmotor is the first emergency ventilator in the world to be produced on a large scale and controls inhalation and exhalation using a modified clock with a cam disk.
• **1947 – Iron Lung**
  Many patients must be given long-term ventilation following the outbreak of a global polio epidemic. This is not possible with the conventional ventilators. The "Iron Lung" functions like an artificial diaphragm and supplies the lungs with fresh air by generating a preset, artificial positive and negative pressure.

Positive pressure ventilation brings about a renaissance

• **1960-1970 – Assistors**
  Compared to the alternating pressure ventilation used in the "Iron Lung", positive pressure ventilation and Dräger's series of so-called assistors promise improved ventilation control options. Mechanical strokes are initially generated pneumatically, then later electronically using timers. For the first time, the patient can also trigger the ventilation stroke through attempts at spontaneous breathing.

• **1955 – Spiromats**
  Compared to assistors, which are pressure-controlled, the "Spiromat" ventilator - developed parallel to the assistors by Dräger - allows volume-oriented, time-controlled ventilation. These long-term ventilators can keep the ventilated volume constant and are the precursors of modern Dräger intensive care ventilators. However, spontaneous breathing is not possible with this type of device. Patients must be sedated medically.
The arrival of microelectronics

- **1982 – Electronic ventilator EV-A**
  Breathing gas flow and ventilation pressure can be controlled more accurately and faster than before using electromagnetically driven valves. The introduction of micro computers allows doctors to use a completely different ventilation model. Dräger is also the first manufacturer to integrate a graphic monitor, which displays ventilation curves as well as numeric data and text messages.\(^7\)

The modern era of intensive care ventilation

- **1985 – present day – Evita intensive care ventilators**
  Dräger’s Evita range of products, which still exists today, introduces pioneering innovations. In 1988, with the Dräger-developed BIPAP ventilation mode (Biphasic Positive Airway Pressure), Evita becomes the first ventilator to allow the patient to breathe spontaneously at any time during ventilation.\(^8\) Spontaneous breaths open collapsed alveoli, continuously improving the gaseous exchange in the lungs. The benefits are not only seen in the form of a reduced ventilation period.\(^9\) According to a study, BIPAP can increase life expectancy among patients suffering from a rare nerve disease, amyotrophic lateral sclerosis (ALS).\(^10\)

- **2000 – Introduction of turbines**
  The Savina ventilator is the first to generate the breathing gas and corresponding positive pressure itself: A small turbine, the so-called side channel compressor, takes in ambient air and supplies the required ventilation pressure.\(^11\) The advantage here is that the device must not be connected to a central gas supply in the hospital, meaning it can be used more flexibly.

- **2003 – Software aids patient weaning**
  For the first time, the new SmartCare/PS ventilation mode allows patients to be automatically weaned from intensive care ventilators without hospital staff having to actively intervene. The mode automatically adjusts the pressure support and performs a spontaneous breathing test.\(^12\)
2011 – Visible ventilation.

**Electrical impedance tomography (EIT) for everyday hospital use**

With the PulmoVista 500, Dräger offers the first electrical impedance tomograph developed for everyday use in hospitals. With up to 50 images per second displayed on the screen, the doctor can see at the patient's bedside how the ventilation is distributed in the lungs. This can help the doctor to tailor the therapy as specifically as possible to the patient's needs. This can effectively support ventilation that protects the lungs.

(4,979 characters incl. spaces)

Sources:

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9. Putensen C, Wrigge H: Clinical review: Biphasic positive airway pressure and airway pressure release ventilation; Critical Care, Dec 2004; Vol.8 No.6, p. 496