

# The Infant Incubator in Europe (1860-1890)

In the nineteenth century, obstetricians in Europe began to construct devices to incubate infants in increasingly controlled environments. The infant incubator is a medical device that maintains stable conditions and a germ free environment for premature infants born before the thirty-seventh week of pregnancy. Records show that physicians had used infant incubators since 1835. However, Jean-Louis-Paul Denucé, a physician who worked in Bordeaux, France, first published about incubator technology in 1857. Carl Credé released his incubator model in Germany in 1860 and Stéphane Tarnier further developed the model in 1884. The infant incubator technology provides a stable environment for premature infants and helps keep them alive.

Infants born pre-maturely are often unable to maintain a constant body temperature and are at risk for hypothermia. The function of an infant incubator is to provide a stable environment in which pre-mature infants can be cared for during the remainder of their development. In 1857, physician Jean-Louis-Paul Denucé published a description of an infant incubator consisting of a large zinc metal tub with a smaller metal tub set inside. In Denucé's description, both tubs were welded at the top edges with a small opening near the top where warm water could be poured inside. The incubator also had a drain at the bottom to drain water that had cooled.

In the 1860s, obstetrician Carl Credé in Germany built his first infant incubator. Pediatrician Julius Hayes Hess, in his 1922 book *Premature and Congenitally Diseased Infants*, noted that writers from France often attributed the origin of the infant incubator to Denucé. However, Credé created his model independently of Denucé. Credé built and implemented his incubator model in 1861 while serving as the director of the Leipzig Maternity Clinic, later renamed as the Leipzig University Gynecological Clinic in Leipzig, Germany. Credé's incubator was also a double-walled metal tub, but it differed from Denucé's model in that it circulated warm water to heat the surrounding walls. Instead of keeping the incubator on the floor, Credé placed it on a stand with a hose attachment that connected to a hot water faucet, making it easier to replace water as it dissipated the heat. For the next twenty years, Credé used his incubator to treat pre-mature infants at a public institution for children that had been abandoned, called the Moscow Foundling Hospital or *Vospitatelnoi Dom* in Moscow, Russia. Hospitals across Europe used Credé's incubator until 1881, when obstetrician Stéphane Tarnier developed a different model.

Stéphane Tarnier developed his incubator model independently of Denucé and Credé. In 1880, Tarnier visited a bird exhibit at the Paris Zoo in Paris, France, where he later said he was inspired by an egg hatching incubator used by zoo director Odile Martin. Tarnier later asked Martin to build a modified incubator for him large enough to fit a human infant. That incubator could hold up to four infants at once and was made of a thick glass lid and wooden box frame with sawdust-insulated walls that could radiate heat and warm the infants. The incubator was placed upon a water tank heated with gas or alcohol that included a thermosiphon to separate fumes from the lower compartment of the box from the higher compartment that containing the infants. A thermosiphon circulates liquids and volatile gases for heating and cooling applications, such as heat pumps, or water heaters. In Tarnier's design, air circulated from the bottom of the incubator through vents above the infant. Despite the thermosiphon, there was still a risk the incubator could fail or overheat and kill the infants inside.

To lessen the risk of overheating, Pierre Budin, a student of Tarnier, modified the incubator by introducing a thermostat and a temperature sensitive alarm that would alert caregivers if there was a problem. Also, nurses placed a thermometer into the incubator to monitor temperatures without directly opening the box. In 1883, Tarnier's student Pierre-Victor Auvard published a report in

which he stated that Tarnier's model reduced the infant mortality rate in half. Together with Auvard, Tarnier developed a model in response to the nurses in the maternity wards who had previously had to fill the water reservoir three times a day because they thought the thermosiphon seemed too risky to keep on for the whole day. The Auvard-Tarnier model was also a two-tiered sawdust insulated box, but instead of a tank it was heated with removable clay water bottles. Nurses could replace the water bottles with ease and did not have to frequently re-fill the device. At the time, this model was affordable, which encouraged hospitals to adopt it.

The Tarnier-Auvard incubator model became increasingly popular device in maternity wards in Paris until the 1890s, and it spread to the US. In 1887, John Bartlett, a physician at the Chicago Polyclinic, later renamed as the John H. Stroger, Jr. Hospital, in Chicago, Illinois, replicated Tarnier's incubator. Bartlett's incubator differed from Tarnier's original plan only slightly. Incubators designed during the late 1800s were mainly focused on keeping the infant isolated, clean, and warm. The early developers of incubators recognized the need to give premature infants a stable and sterile environment to provide the care they needed to survive.

## Sources

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