



A Brief History of Cooling

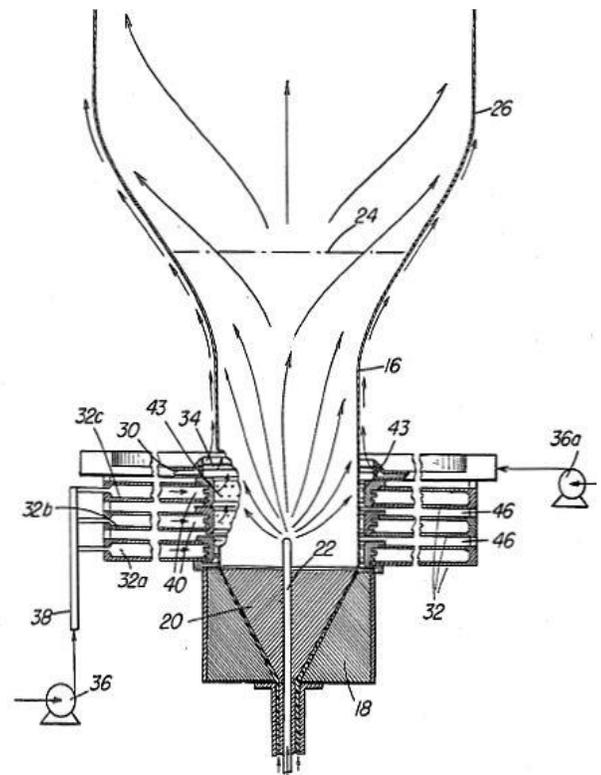
by Bob Cree 2016

To remain competitive, blown film manufacturers must maximize output and quality, however cooling system performance has been a significant limiting factor...until now.

Many different commercially available cooling systems have been developed by OEMs, both external and internal to the bubble. To varying degrees these systems have achieved success. Internal cooling (IBC) systems have evolved significantly over the years, and together with external systems, generate significant additional output. Unfortunately, IBC systems cannot always be used, depending on such factors as operator skill, thermoplastic material properties, and the physical size and design of the associated die. In contrast, external systems are the cooling workhorse for the industry, providing the majority of cooling and stabilization across the full range of Blown Film processes.

The earliest external cooling element, known as a "Single Flow Air Ring", still in common use today, applies a single flow of cooling air around the bubble, and typically produces good film quality, but at lower output rate. By applying well known Bernoulli and Coandă principles, additional flows of cooling gas have been added over time to create various multi-flow cooling element designs, such as "Dual Flow", "Triple Flow" or even "Quad Flow" air rings. To gain additional output and/or stability, various cooling elements have been paired, depending on the application, to form what is generically known as a "Tandem Air Ring". Typically air rings are fixed in place, but in some cases are height adjustable above the die, to allow extending the cooled surface area along the bubble. This can produce even higher output, but also results in greater unsupported surface area above the die, which unfortunately, is the hottest and weakest portion of the bubble. This can lead to degraded stability, making it more difficult to operate the extrusion line.

And then there are cooling systems developed by end users...one in particular stands out...back in the 1970's, Jack Herrington of Mobil Chemical developed a very high output cooling system called the "Herrington Stack", publicly acknowledged in a series of patents, with outputs that were truly extreme, well in excess of anything else ever seen in blown film production. This system literally takes cooling to the limit of what the polymer can handle before ripping to pieces, and imparts enhanced physical properties to the film due to its ability to impose a preferred shape to the bubble. This cooling system has produced billions of pounds of product, but unfortunately, with significant downsides...high frequency gauge variation, high noise levels and difficulty in stabilization, which has limited this design to just a few select blown film applications. With the huge upside of extremely high output, many attempts have been made over time, to try and solve these problems...



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