CoorsTek

CASE STUDY

CERAMIC CAN TOOLING

CoorsTek helps the aluminum can industry produce billions of cans and save millions of tons of aluminum each year.

SAVING MILLIONS OF TONS

Aluminum cans are ubiquitous in the beverage industry. While the simple cylindrical shape is still utilized after 200 years of use, modern aluminum cans require sophisticated technology to meet modern demands. Aluminum can production lines are often designed to manufacture 2,000 cans per minute, each with walls thinner than a human hair. Manufacturing at this speed and precision relies heavily on wear-resistant tooling made from durable materials that can run continuously while forming cans to tight tolerances.

CoorsTek provides a variety of tooling components engineered specifically for can production—taking advantage of the unique material properties of its advanced zirconia ceramics. One of these components is a necking die, designed to create the slight taper at the top of each can which reduces the cross section of the top of the can. This slight size reduction is propagated to the nearly 100 billion cans manufactured per year—saving millions of tons of aluminum each year. CoorsTek engineers the necking dies from YTZP, which combines high wear and corrosion resistance, a mirror surface finish, and low component weight. This unique combination has been implemented to help can manufacturers produce better products at faster speeds with longer run time.

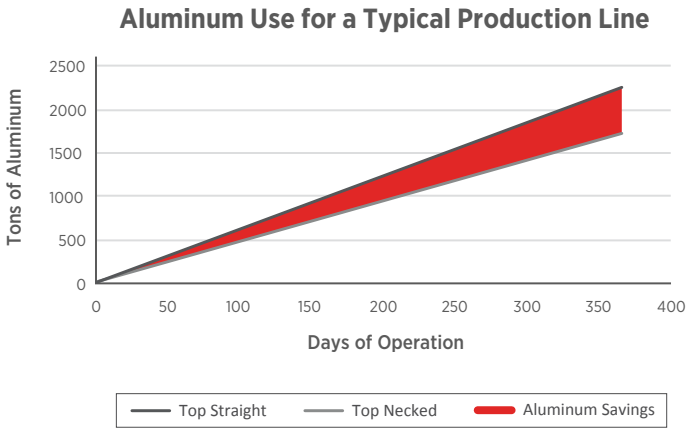

Figure 1: Aluminum savings over a year from necking can tops for a typical production line

ALUMINUM CAN EVOLUTION

The Coors Brewery pioneered the recyclable aluminum beverage can using a straight-walled design. However, the lid requires thicker aluminum stock then the body. In 1972, to reduce material costs, CoorsTek was among the first companies to design a mechanism for necking aluminum cans. This investment eventually positioned CoorsTek to help create next-generation solutions for manufacturers who did not heavily invest in necking technology until the late 1980's .

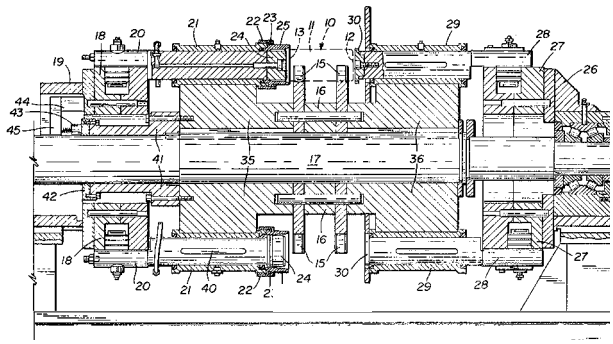

Figure 2: CoorsTek necking patent 1972

As the lid diameter continued to evolve to smaller sizes, the cans needed to be necked down further. However, two technological hurdles, mechanical and material, constrained further neck reduction and faster production speeds.

Figure 3: Comparison of the original vs. modern can

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ADVANCING NECKING TECHNOLOGY

There are two basic processes for necking cans: spin-necking and die-necking. Although the industry originally adopted the spin-necking technology, it was unable to maintain both the required precision and increasing production rates. As the industry shifted toward die-necking, multiple stage die necking systems proved to be a robust process to achieve higher can-per-minute rates. While the industry-wide adoption of die-necking dramatically increased productivity, further gains were limited due to the relatively short useful life of the dies.

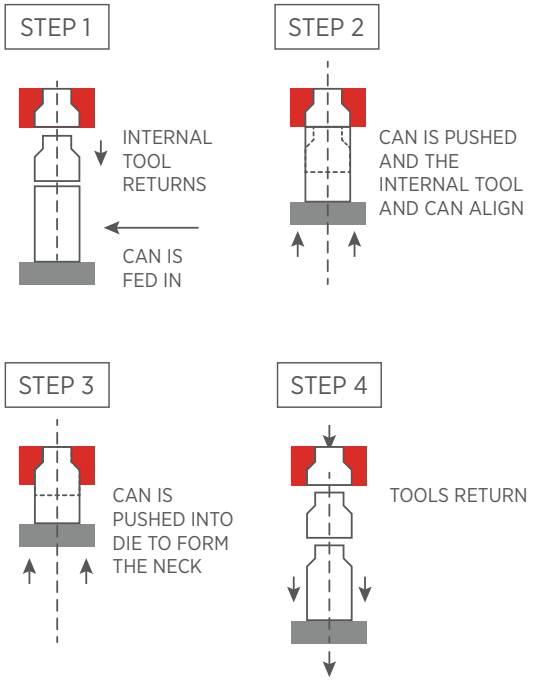

Figure 4: First stage of multiple in necking a can. Subsequent stages use different angles for optimal can neck

ADVANCING CERAMIC MATERIALS TECHNOLOGY

Conventional steel tooling wore out rapidly at new production rates of over 750,000 cans in an 8-hour shift. Tungsten carbide dies helped to reduce the wear, but its metallic binder phase was the weak link. The binder phase, which holds together the tungsten carbide particles, wears out more quickly than the tungsten carbide and can be leached out by coolants — creating small pores on the die surface. These pores caused major defects on the hair-thin can walls, forcing manufacturers to shut down the line to repolish the dies.

CoorsTek saw these limitations and began working to engineer a better solution — creating durable ceramic dies that ran month after month while delivering a perfect product each time.

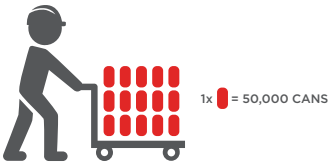

Figure 5: Number of cans produced in the time of a single 8-hour shift

Through experimenting with various innovative ceramic materials, including early ceramic matrix composites (CMC) known as "whisker reinforced aluminas," CoorsTek engineered an advanced yttria tetragonal zirconia polycrystal (YTZP) ceramic with the optimal combination of wear and corrosion resistance, mechanical strength, and surface finish.

Figure 6: YTZP necking die

The use of CoorsTek ceramic dies enabled can production lines to be more efficient than ever before, gaining market adoption and a growing preference. CoorsTek extended the reach of ceramic tooling by proving die blanks to tool and die finishers, giving carbide tool providers a more durable ceramic option.

CONCLUSION

The simple aluminum beverage can began a recycling mindset that has made an enormous positive impact on our environment. Sophisticated processes make production faster and more efficient. And CoorsTek helps enable these improvements by engineering ceramic components like durable necking dies that help save millions of tons of aluminum each year.

Through a unique combination of mechanical strength, corrosion and wear resistance, and mirror-smooth finish, CoorsTek advanced ceramics like YTZP zirconia deliver a lower total cost of ownersihp — helping machinery and equipment last longer, shape more precisely, and operate more efficiently with better uptime.

REFERENCES

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