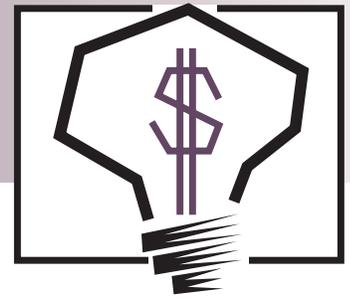


INVENTIONS & INNOVATION

Success Story



AEROCYLINDER REPLACEMENT FOR SINGLE ACTION CYLINDERS

Aerocylinder Prevents Air Loss and Reduces Downtime

Benefits

- ◆ Has saved over 346 billion Btu cumulatively through 2000
- ◆ Saves an average of 32,000 kWh per year per installation
- ◆ Improves productivity by reducing downtime and prolonging equipment life
- ◆ Has saved \$4.7 million in energy purchases through 2000
- ◆ Improves equipment performance leading to consistent quality
- ◆ Enhances safety by preventing failure of high-pressure systems
- ◆ Has avoided 23,000 tons of CO₂ emissions through 2000
- ◆ Eliminates air loss, which provides consistent force, repeatability, and quality

Applications

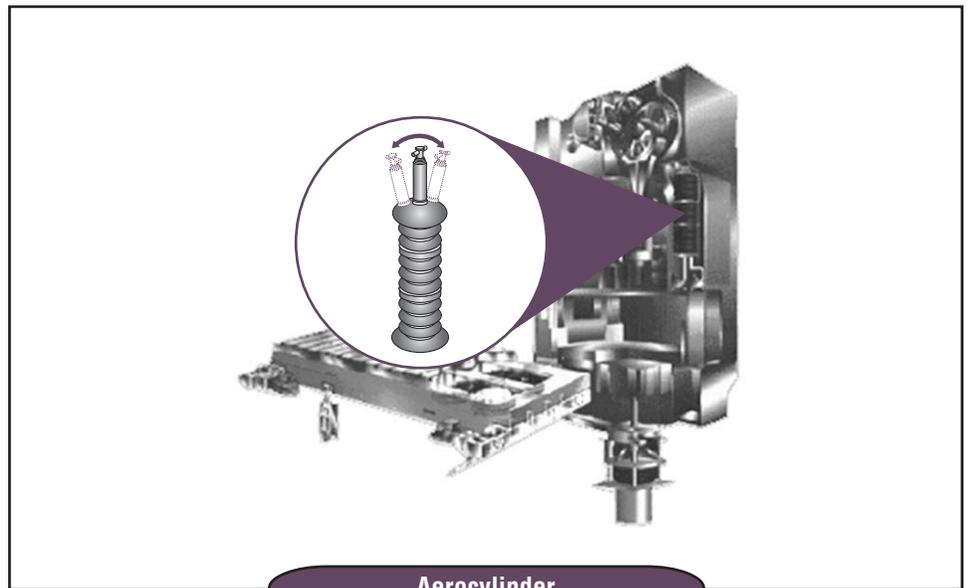
Aerocylinders were designed for the metal-forming industry and are used by Ford and GM for automotive part stamping. Applications include metal forging as well as uses in the mining, forestry, offshore drilling, and steel industries.

“Without these [DOE] funds the opportunity would have passed us by.”

– Ken Smedberg
President
Inventor of Aerocylinder
Smedberg Machine Corporation

Compressed air is used to power equipment and tools and in industrial processes for pressurizing, atomizing, agitating, and mixing. Electricity is used to generate compressed air. Although it is the most expensive utility, compressed air is typically included in the overall electrical bill for a plant and is widely viewed by production staff as “free.” For every one cubic foot per minute (cfm) of compressed air generated, 2 cfm are estimated to be wasted.

In addition to energy loss, leaks also translate into decreased productivity and quality. The leaking, however, can often be traced to conventional air cylinders. One metal stamping plant, part of a large car manufacturing plant, estimated that 60% of its annual compressed air bill resulted from leaking cylinder seals from a conventional air cylinder in its stamping press. Although the metal stamping press, which stamps designs into sheet metal to form products such as car doors, made mass production and the industrial revolution possible, innovation in its basic components had been almost nonexistent since the turn of the century.



Aerocylinder



Conventional air cylinders are used both as die cushions to assist in holding sheet metal during a forming operation and as counterbalances to soften the shock to the press components. These conventional die cushions and counterbalances and their air piping had to be repaired every 3 to 6 months to avoid excessive compressed air loss and faulty stamping. With a grant from the U.S. Department of Energy's Inventions and Innovation program, George Bozich and Kenneth Smedberg developed a new cylinder, the Aerocylinder, to alleviate the inefficiencies and high maintenance costs of conventional air cylinders.

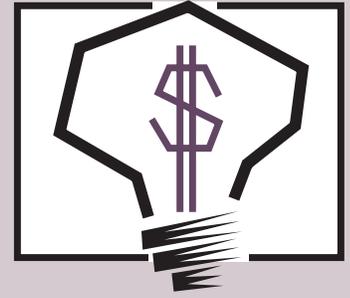
Technology Description

The Aerocylinder is made of stacked airbags (called actuators), which have no moving parts to wear out or rigid guidance systems to become misaligned. The airbags are flexible containers made up of elastomers (usually synthetic rubber) and fabric. Like automobile tires, the specific materials used and the number of plies determine the strength and flexibility of the different actuators designed for different service and tonnage ratings. The most significant advantage of the Aerocylinder over existing technology is that it prevents compressed air loss. Other advantages include part-forming consistency, much longer run times between scheduled maintenance, minimized unscheduled downtime, and a lower initial cost. Consistent air pressure provides 10% productivity and quality improvements; and used as a counterbalance, it reduces pressing and return shock loads. Conventional cylinders can require repair after 1.5 million strokes or less, but the new Aerocylinders have been stroked in excess of 45 million times without failure.

Energy Savings and System Economics

Eliminating compressed air leakage on seven stamping presses with the new Aerocylinder helped a large U.S. car manufacturer save approximately \$200,000 per year. The savings are due entirely to reduced energy usage for compressing the necessary air. Cumulative energy savings through the year 2000 for all installations have surpassed 346 trillion Btu. The associated reduction in CO₂ emissions is estimated to be 23,000 tons, and avoided energy purchases total \$4.7 million.

The innovative Aerocylinders were designed for the metal forming industry but are applicable in mining, forestry, offshore drilling, steel, and other industries. The Aerocylinder continues to operate efficiently if it becomes misaligned; it enhances safety with the rubber cylinder; it operates under water; and it eliminates the need for filtered air and lubrication. After the commercialization of the Aerocushion, the engineers at Smedberg Machine Corporation identified a new product better suited for certain stamping applications than the cushion – a hydraulic cylinder able to be incorporated directly into the die to absorb the initial impact shock, provide a customized force response throughout the stamping cycle, and reduce the return shock at the end of the stamping operation. This product is called the Force Modulator™ and in 2001 was selected for use on new Ford Motor Company dies. This cylinder can solve a critical problem that has limited use of aluminum and ultralight steel in large auto body panels and has reduced defective parts and press damage.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and to conduct early development. Ideas that have significant energy-savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

For project information, contact:

Ken Smedberg
Smedberg Machine Corporation
7934 South Chicago Avenue
Chicago, IL 60617-1097
Phone: (773) 734-8000
Fax: (773) 734-3985
SMCorp@worldnet.att.net

Home Page:
www.smedberg.thomasregister.com

For more information about the Inventions and Innovation Program, contact:

Lisa Barnett
Program Manager
Inventions and Innovation Program
U.S. Department of Energy
1000 Independence Avenue SW
Washington, D.C. 20585-0121
Phone: (202) 586-2212
Fax: (202) 586-7114
lisa.barnett@ee.doe.gov

Visit our home page at
www.oit.doe.gov



Order # I-OT-519
September 2002