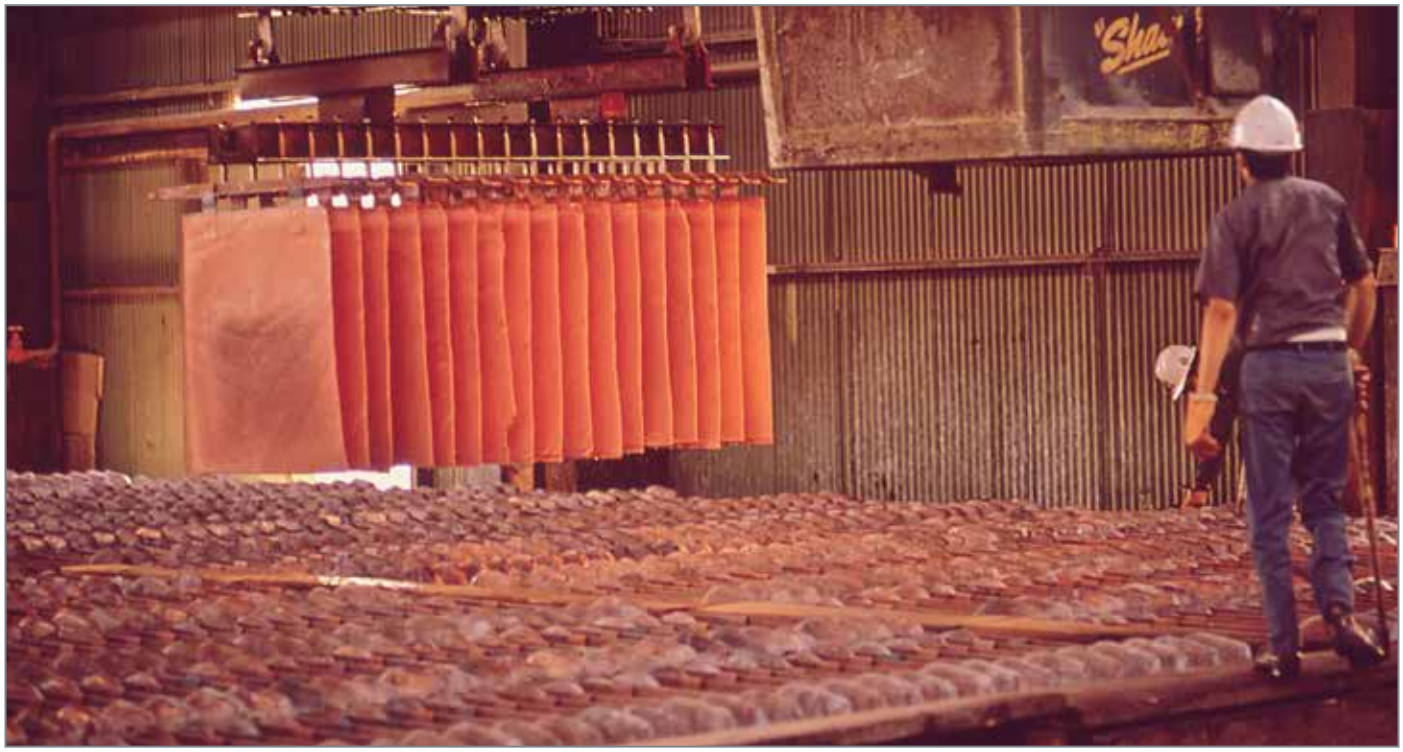
Delivering Application Flexibility in Mining Operations

FROM BASIC DEWATERING APPLICATIONS TO PRECISE ELECTROWINNING PROCESSES
WILDEN® AODD PUMPS ARE TYPICALLY THE BEST CHOICE FOR MINE OPERATORS

By Greg Duncan



Electrowinning, here being performed at a copper mine, is a mining process that extracts metals and minerals from ores that have been put in solution via leaching. Key to the success of the electrowinning process are the pumps that are used to introduce various chemicals to the operation. Wilden® offers several models of air-operated double-diaphragm (AODD) pumps that have been proven to operate effectively in electrowinning activities.

The early stages of mine development can be pretty elemental: identify where the lodes are buried, then get out the large pieces of machinery, i.e. the towering trucks, shovels, drills, crushers and haulers, along with some dynamite, and start digging until you've reached paydirt, the spot where the ore is located, then bring in the conveyors and start moving the commodity-laden ore to the surface.

These are extremely rugged operations and require equipment that can withstand long, hard days of work, and reliably function in extreme weather conditions. This includes not only the heavy machinery that digs and works the mine, but also the ancillary equipment that helps optimize the mining process. Industrial pumps are a key component in the mining production chain and are called upon to perform a number of critical duties during mine construction, from dewatering applications to waste-oil transfer. These duties demand pumps that are rugged enough to handle slurries consisting mostly of mud and rocks.

Rough And Delicate

While the overriding image of mining is one centered on brute force, the industry has a delicate side as well. While it's great when the mine operator can hit a rich lode that is easily extractable, the majority of the time it's not that simple. In those cases, precise, exacting processes are required to ensure that the mine is being worked to a level where commodity extraction is optimized. That's where processes like "electrowinning" come in.

While the word "electrowinning" has a space-age sound to it, in actuality it is the world's oldest industrial electrolytic process, having been discovered by English chemist Humphry Davy in 1807 and patented commercially in 1865 by James Elkington in Wales. The first commercial electrowinning plant in the United States was established way back in 1883 in Newark, NJ.

Electrowinning is defined as the extraction of metals and minerals from their ores that have been put in solution via a process known as leaching. In the electrowinning process, a

Wilden® Original™ and Advanced™ Series AODD Pumps possess the design and materials of construction to handle the harsh, corrosive or hazardous chemicals that are used to optimize a mine's electrowinning processes.

current is passed from an inert anode through a liquid solution containing the metal or mineral so that it is extracted by being deposited onto the cathode via an electro-plating process. Common uses for the electrowinning process are for the extraction of copper, gold, silver, platinum, zinc, aluminum, cobalt, manganese and a variety of minerals.

The electrowinning process requires the introduction of various types of harsh, corrosive or hazardous chemicals into the mining operation; cyanide, for instance, is used when electrowinning for gold. These chemicals are introduced into the ore during the leaching process, which helps to separate the minerals or metals from the ore before a second chemical process pulls the commodity out during electrowinning. Electrowinning enables the recovery of minute, but very valuable, metal or mineral particles, with as much of 20 tons of soil required to extract, for example, one pound of platinum.

The Common Denominator

The link between the rough and tumble of mine excavation and the precise operation of electrowinning is the fact that industrial pumps are required to optimize both processes. One type of pump style—air-operated double-diaphragm (AODD)—has been proven in the field to be flexible enough to offer the ruggedness and reliability for operations such as mine dewatering, as well as the ability to handle corrosive chemicals during electrowinning operations.

AODD pumps are able to perform effectively at both ends of the mining spectrum because their method of operation allows them to easily handle variable flow rates and pressures, while being dry-run capable and nimble enough to transfer liquids that are shear-sensitive or high-viscosity, as well as slurries laden with rocks, pebbles and other particulates.

The simple design of the AODD pump features few moving parts, which simplifies maintenance, while the pump's sealless design results in fewer leaks, which is a critical consideration when handling hard-to-seal or hazardous liquids. AODD pumps are available in both metal and plastic housing constructions, while a wide array of elastomers can be used in the diaphragms, which eliminates many chemical-compatibility concerns.

The wide variety of AODD pump configurations provides operational flexibility that can also result in optimized efficiency at many levels. The ability to feature AODD pumps in a wide range of applications, from basic general-use to delicate electrowinning processes, allows the operator to more cost-effectively outfit his mine. AODD pumps can also be less costly to operate, especially those models that are outfitted with next-generation mechanically actuated air distribution systems (ADS). And, at their most basic, AODD pumps excel in the typical rugged and harsh operating atmospheres found in mines, which reduces breakdown incidents along with corresponding downtime and repair costs.

Wilden® PX1500 (76 mm/3") Advanced™ Series Metal AODD Pump

Wilden® AODD Pumps possess the operational characteristics necessary to perform reliably in a variety of rough-and-tumble mining applications, including the transfer of slurries laden with rocks, pebbles and other particulates. AODD pumps also excel in the typical harsh operating atmospheres found in mines, which reduces breakdown incidents along with corresponding downtime and repair costs.

Since AODD pumps do not require electricity to operate, they offer the added benefit of helping to improve mine safety, especially when used in potentially explosive atmospheres. Over the years, the level of mine safety has taken great leaps forward, which was proven out in 2013 when the Mine Safety and Health Administration (MSHA) reported that the fatality rate in United States mines was its lowest ever in 2012, based on the number of man-hours that were worked during the year. Additionally, the MSHA reported that actual work-related fatalities in mines totaled 36 for the year, which was just one more than the best-ever fatality total of 35 in 2009. This improvement in safety is a positive development not only for mine personnel, but also for surrounding communities and the environment.

AODD pump technology was invented by Jim Wilden in 1955, who went on to form Wilden® Pump & Engineering Company, LLC, in Grand Terrace, CA, USA. Wilden's AODD pump technology has been proven over the ensuing years to excel when used in the entire array of mining applications.

Specifically, Wilden offers its Original™ Series and Advanced™ Series Metal and Plastic AODD Pumps, which can be used for both dewatering operations and chemical transfer in electrowinning processes. Wilden's Stallion® clamped metal AODD pumps incorporate many design enhancements that make them the first choice for various mine operations. Chief among these are a shock-absorbing polyurethane screen base that absorbs the impact from constant assault by solid particles, resulting in maximized durability. Stallion pumps also feature an integrated suction strainer, with the option of plumbed suction, if needed.

Stallion pumps also offer Wilden's patented Pro-Flo X™ Air Distribution System (ADS) with the Efficiency Management System (EMS™). The EMS allows the user to control flow rates and air consumption with the simple turn of a dial. Wilden's Stallion pumps are available in three sizes: PX4, 38 mm (1-1/2"); PX8, 51 mm (2") and PX15, 76 mm (3"). All are available in either aluminum or ductile-iron materials of construction, are submersible, intrinsically safe, lube-free, can run dry, have superior anti-freezing properties and can handle pressures to 125 psi. Depending on the model, flow rates range from 305 to 1,000 L/min (81 to 264 gpm).

Wilden® Original™ Series Stallion® Metal AODD Pumps

Wilden® PX8 (51 mm/2") Original™ Series Metal AODD Pump

Wilden also offers various Original and Advanced plastic AODD pumps in polypropylene or PVDF materials of construction, which make them ideal for handling the oftentimes corrosive or hazardous acids, caustics or solvents used in electrowinning. Elastomer options include Buna-N, Neoprene, Viton®, PTFE or Wil-Flex™. These pump models also have the ability to incorporate Wilden's innovative new Pro-Flo® SHIFT ADS, the operation of which has been shown to produce up to 60% savings in air consumption and associated operational costs.

Finally, Wilden has recently added the Advanced™ FIT Series AODD pumps to its product portfolio, which can be ideal for electrowinning and other chemical-handling applications within mining operations. Featuring stainless-steel or aluminum wetted paths, the Advanced FIT pumps have been designed to "fit" bolt-to-bolt and pipe-to-pipe within existing fluid-handling systems, making them an ideal drop-in replacement for either Wilden pumps or competitive models. The Advanced FIT pumps are also able to incorporate the Pro-Flo SHIFT ADS for increased savings in air consumption and operational costs.

Conclusion

The flexibility of AODD-style pumps becomes readily apparent when considering their various uses in mining operations. Not many pumps can handle both solid-laden slurries during dewatering and highly corrosive chemicals in electrowinning processes. AODD pumps, especially the

Wilden® PX420 (38 mm/1.5") Advanced™ Series FIT Metal AODD Pump

Wilden Original, Advanced, Advanced FIT and Stallion Series models, possess both the ruggedness needed for mine excavation and the precision required for electrowinning, all of which make them the perfect choice when flexibility is a deciding factor in mining-operation pump selection.

Viton® is a registered trademark of DuPont

About the Author:

Greg Duncan is the Director of Business Development for Wilden® and PSG®. He can be reached at (909) 422-1700 or greg.duncan@psgdover.com. Wilden is a leading brand of air-operated double-diaphragm (AODD) pumps. For more information, please go to www.wildenpump.com. Wilden is part of PSG®, a Dover company, Oakbrook Terrace, IL, USA. PSG is comprised of several leading pump brands, including Abaque®, Almatec®, Blackmer®, Ebsray®, Griswold™, Maag Industrial Pumps, Mouvex®, Neptune™, Quattroflow™, RedScrew™ and Wilden®. You can find more information on PSG at www.psgdover.com.