Selling the Hydra-Cell

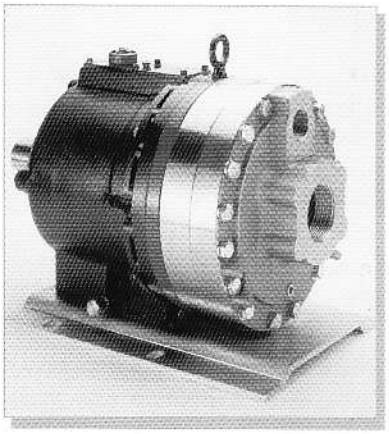
The pump buyer faces a bewilderment of possibilities when it comes to choosing between one pump type and another. So when your pump's operating concept sits unique among all the others, bringing it to the buyer's attention can be a daunting task. Wanner's Hydra-Cell is a case in point – it uses an exclusive and unusual hydraulically balanced diaphragm design, patented by Wanner Engineering. Michael Cotter spoke to Dennis Heath, managing director of Wanner International, about the origins of the pump, about its latest capabilities, and about the ongoing process of introducing such a design to the marketplace. The key, he believes, lies simply in communicating the potential of the product.

Explain the background behind Wanner International

We're owned by a private American company run by Bill Wanner. His father, who's now deceased, was the inventor of the Hydra-Cell, around 1975. He had a reputation as an innovator, a scientist, with various patents in other areas. He was looking for a sealless pump that could deliver some pressure and could handle some particulate content. He'd got a few applications in mind – one was the car wash business, another was reverse osmosis. He couldn't find a pump anywhere, so he designed one and patented the central idea – the Hydra-Cell. But he wasn't the entrepreneur type, so he simply produced a pump to solve his particular technical problem. But it was his son, Bill – who trained as a lawyer – that saw the commercial potential in the idea.

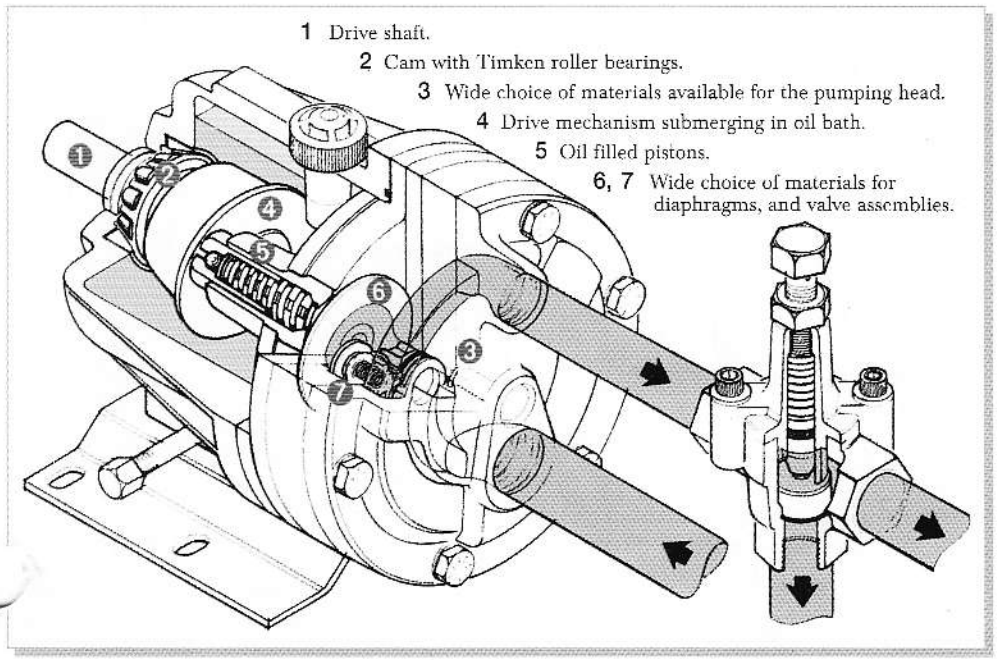
They started with the Size 10 model, (flow up to 10 US gpm) then extended to other sizes, and eventually developed a full range of products all based around the original hydraulic cell. As the design's been enhanced, so the patents have been updated. So, although we're a relatively young business, this process of ongoing innovation gives us the chance to grow.

Around 1985, the Wanner International operation was set up. The idea was that we then start looking at international distribution throughout Europe. In the intervening fifteen years, we've established close partnerships with distributors in all the main European countries. We're now in a programme to push the business further east, into Central Europe, the Middle East and India. It's a process of close collaboration with these partners, because we don't sell a "catalogue product" – it needs to be right for the application.



The Hydra-Cell G35. Its five-diaphragm design has further increased flow and pressure capability in relation to size.

The operating principles of Wanner's Hydra-Cell pump.



Over the years, and particularly from 1998, Bill Wanner has made significant investment in the production plant in Minneapolis, and in the product development program. We're now looking at developing another family of pumps, based on the latest improvements in the Hydra-Cell design. We'd expect to see those in production within 3 to 5 years, but this year, in fact, we've come out with a modified version which allows us to at least double the achievable pressure.

What's your working relationship with distributors?

While we're very enthusiastic about our product, we almost take a pessimistic view of the pump when we talk to our distributors about applications. We say "Be careful about that, watch for this, but look for the many specific areas where the pump fits well. Once you stray too far from those, the customer – as with any mis-specified pump – may experience problems." We need to make them aware of it. This also gives them confidence, because we're being open about the most suitable applications, and cautious where we're at all doubtful.

The abrasive characteristics of this pump, for example, are good, because it's a sealless design. There are, however, certain things you have to watch out for – the type of liquid, the particle size, the materials, the pump speed, how you feed the liquid into the pump etc. We go through all these points with the distributor, so that when they do sell it into the abrasive market, they position the pump correctly, and ensure that the installation does justice to the potential of the pump.

How is the strength of sterling affecting the business?

What we're finding is that it's not so bad when it's a one-off sale. Our distributors are perfectly capable of putting different pump systems together, involving the pump, a motor and a flow or speed controller, and perhaps a feeding unit. When customers are buying in large quantities, margins are tighter and unfavourable exchange rates exert extra pressure.

If you deal with any other European country, you're facing up to a 20% increase in the sterling exchange rate over the last 2 years. So we have to scrutinize our margins, and consider ways of perhaps delivering straight from the U.S. We can quote in dollars, but unfortunately the dollar has tracked the pound's value rise quite closely. So yes, it's becoming more of a problem. Having said that, there are many industries where the pump fits beautifully into their requirements, and customers are happy to pay the price for the enhanced performance.

How Hydra-Cell pumps operate

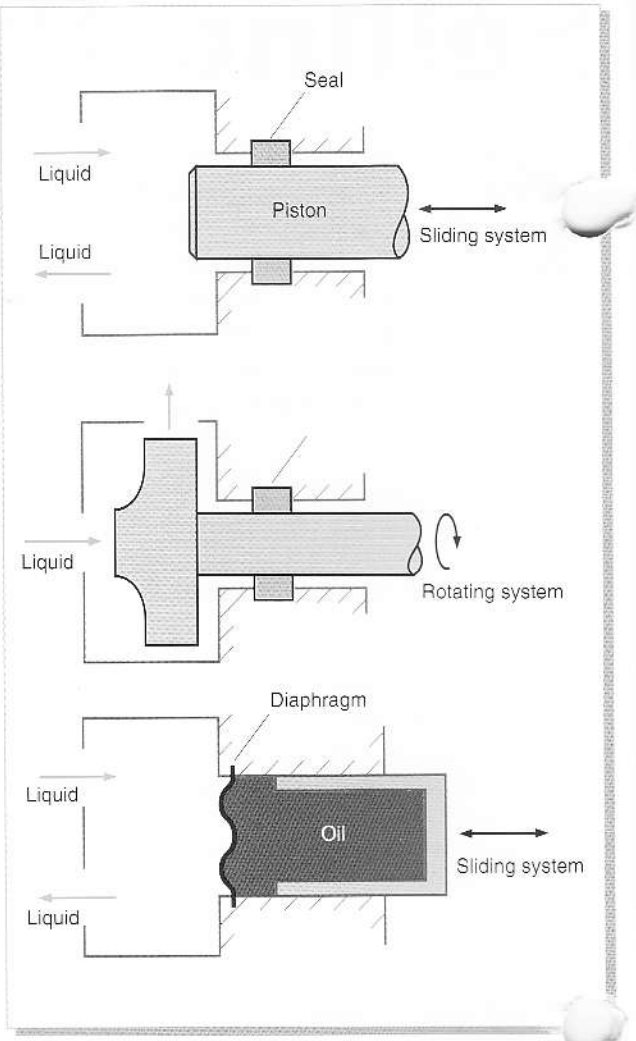
The unique positive-displacement Hydra-Cell pumps operate using the following principle (ref. Figure 1)

The drive shaft (1) is rigidly held in the pump housing by a large Timken tapered roller bearing (2) at the rear of the shaft and a smaller Timken bearing at the front of the shaft. Sandwiched between another pair of large Timken bearings is a fixed-angle cam or wobble plate (4). "The function of the wobble plate," says Heath, "is to translate the rotary motion into linear motion." As the drive shaft turns, the wobble plate moves, oscillating forward and back. This complete pumping mechanism is submerged in a lubricating oil bath.

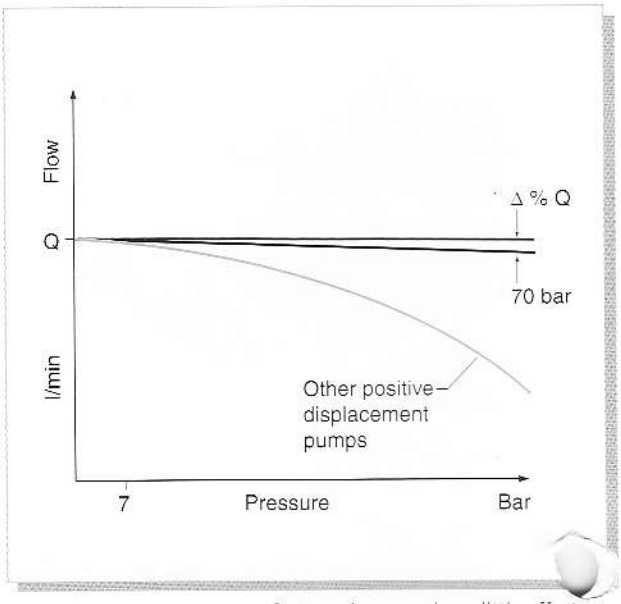
The three Hydra-Cell pistons (5) are alternately displaced by the wobble plate. The pistons are filled with oil on their rearward stroke. A ball check valve in the bottom of each piston ensures that the Hydra-Cells remain full of oil on their forward stroke. The oil held in the Hydra-Cell pressurises the back side of the diaphragms (6) and causes them to flex forward and back as the wobble plate moves, thus providing the pumping action.

To provide long trouble-free diaphragm life, the Hydra-Cell hydraulically balances the diaphragm over the pump's complete pressure range. The diaphragm actually faces only a 2 psi pressure differential no matter what pressure fluid is being delivered. "People ask us," notes Heath, " 'How does that deliver such high pressures?' And of course it doesn't. It's just a barrier between the system fluid and our hydraulic liquid."

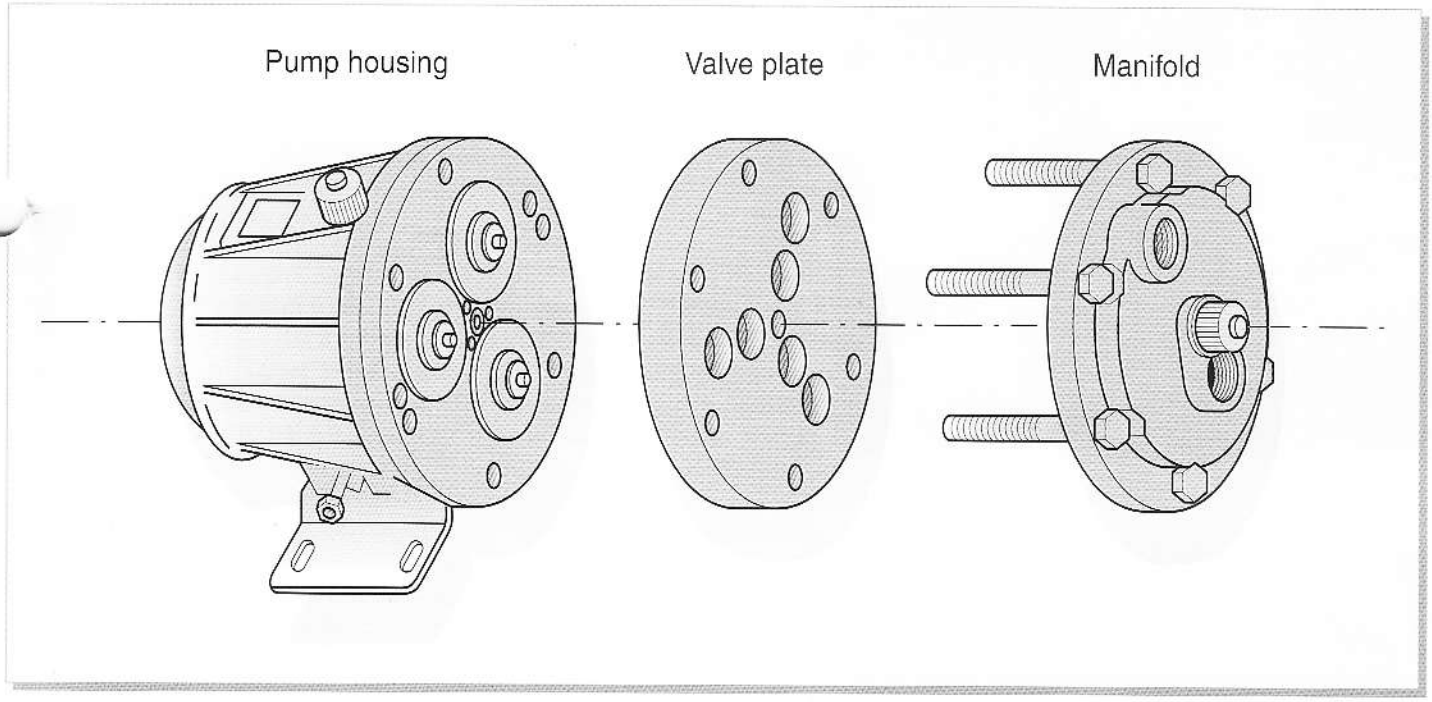
Each diaphragm has its own pumping chamber which contains an inlet and outlet self-aligning check valve assembly (7). As the diaphragms retract, fluid enters the pump through a common inlet and passes through one of the inlet check valves. On the forward stroke, the diaphragm forces this fluid out the discharge check valve and through the manifolded



Three fundamentally different fluid transfer principles.



Pressure increases have little effect on the flow of the Hydra-Cell.



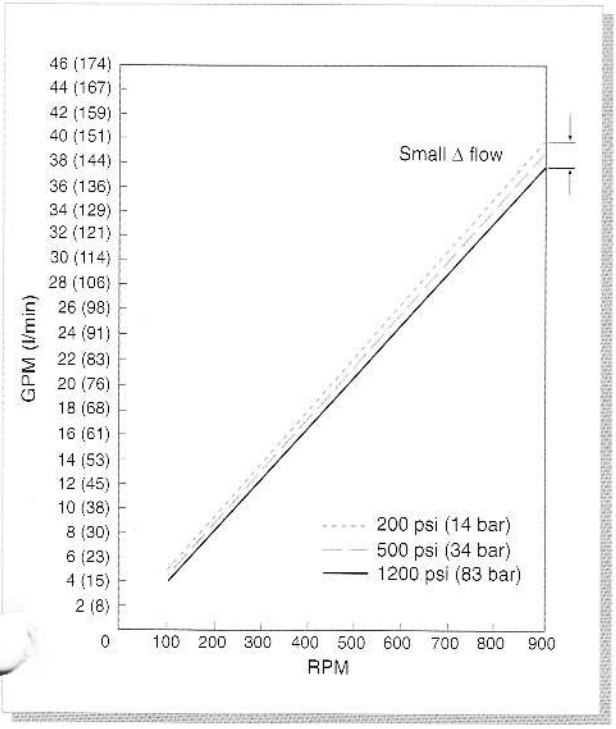
Exploded view of the pump construction.

common outlet. The diaphragms, equally spaced 120º from one another, operate sequentially to provide constant, virtually pulse-free flow of liquid.

The pumps are very efficient (typical operation is at or above 80% efficiency) and can be driven (belt, gear, or direct) by electric, air, or hydraulic motors. This allows system designers flexibility in selecting drives for their machines. The high efficiency offers substantial energy savings to users over comparable pumps. The pumps are available in flow rates from 0.2 to 38 gpm (1 to 144 l/min) at discharge pressures from 30 to 2465 psig (2 to 170 bar).

The pump does not have troublesome cups, packings, or seals – which in conventional pumps can fail unless fine filtration systems are installed on the inlet side.

Typical performance curve.



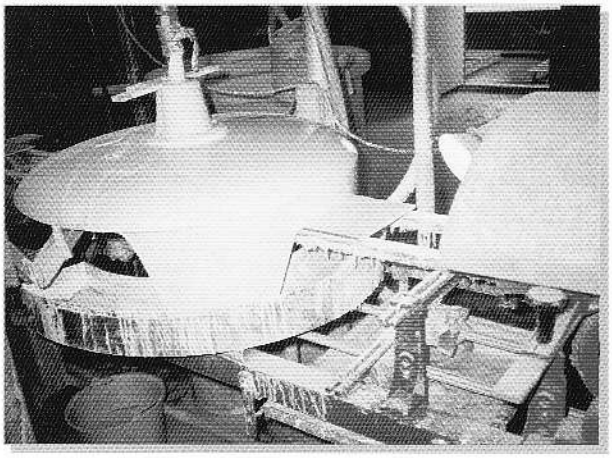
The design is not simply limited to a three-cell approach. One pump in the Hydra-Cell line, for example, the model G35, incorporates five diaphragms instead of the original triplex design. This enables the G35 to produce higher flow and pressure capabilities in an extremely compact size, and to produce particularly smooth flows. This eliminates the need for pulsation dampening devices, and also reduces adverse shock and loads on system components

The slurry duty variation

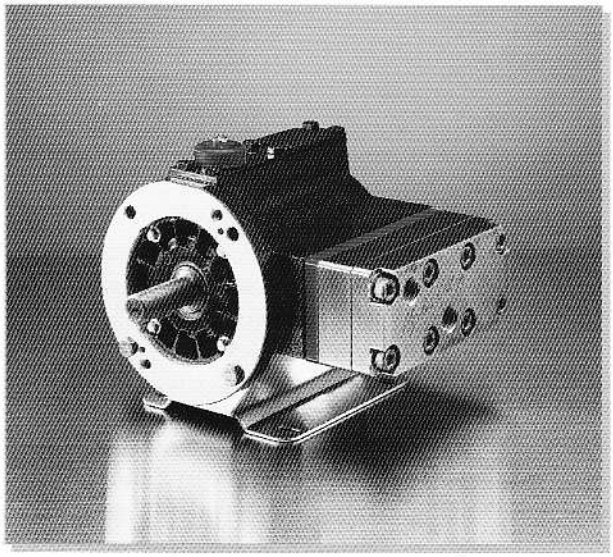
A problem in some industries has been how to pump extremely abrasive materials – for example alumina, silica, lime slurry and glazes – while avoiding rapid pump wear. Customers require improved abrasion resistance over Wanner's standard 'abrasive duty' pump (ceramic valve and seat). With the recently developed slurry duty pump, Wanner hopes to add to its reputation as a manufacturer of pumps that can handle such applications. The company recommends it for pumping applications that require extra abrasion resistance. Wear problems are eliminated by a design that combines the proven Hydra-Cell concept with new purpose-designed valves in a wear-resistant pump head.

In the slurry duty pump, an important feature is the elimination of relative movement between valve assembly components. A crush seal pre-loads the valve assembly, while a valve seat O-ring ensures the groove is 100% filled. Polyurethane wear washers are positioned at the spring ends. A hard valve "poppet" seals against the relatively soft, elastic valve seat. The seat "absorbs" and "releases" abrasive particles, while the large sealing surface ensures reliability and minimizes stresses. Note that all the valve components (not just the valve and seat) are critical to valve reliability in handling abrasive slurry mixtures.

Wanner has already had a number of successes with this novel approach. One leading operator of waste-to-energy incineration plants uses



Ceramic slip presents an extremely abrasive pumping challenge.



The latest Hydra-Cell pump, the Model G04, works at pressures up to 170 bar.

Hydra-Cell pump applications include

Agriculture (e.g. crop spraying)

Ceramics (abrasive liquids)

Construction industry (e.g. trenchless technology)

Desulphurisation

Equipment cleaning

Industrial component degreasing

Machine tools (high pressure coolant)

Mechanical seal flushing

Reverse osmosis (membrane technlogy)

Spray drying

Steam generators

Tree/plant spraying

Urethane foam production

Waste products handling

lime slurry and water for flue gas desulphurisation and cooling of emissions in their stack scrubbers. The 5% concentration of lime slurry caused rapid erosion in the progressing cavity pump originally fitted – shortening the lives of the pump rotor and stator and generating high maintenance costs. Looking for a better alternative, the plant operators installed the Hydra-Cell slurry duty pump. Process efficiency went up because they were able to increase lime concentration from 5% to 20% - but yearly repair costs went down.

Tableware manufacturers, Royal Doulton, substantially cut pump maintenance costs and servicing time after a Hydra-Cell abrasion resistant pump replaced a larger, more expensive unit on a spray drying plant. Delivering ceramic slip (liquid clay mix) at pressure to the spray dry nozzles, the Wanner pump met critical requirements for reliability and consistency and can be serviced on site, with lower parts costs and reduced downtime. Moreover, apparently its smoother performance, with less pulsation , has eliminated the unwelcome build-up of slip material on the spray nozzles.

How does the diaphragm life in the Hydra-Cell pump compare to conventionally actuated pumps?

If you take the perfect situation, which of course there never is, these units can run indefinitely. The diaphragms are hydraulically balanced and designed with a convolution which enables them to flex with virtually no stress or strain. So it's designed for very long life, even at design speeds of over 1000 rpm.

What about efficiency?

It's very good. From the torque power in, to the fluid power out, we get over 80%. That means motor sizes can be smaller than those used by our competitors. We've got an application right now in Sweden, where our distributor there sold one of our bigger pumps into a paper mill. They'd traditionally been using multistage centrifugal pumps for years. They've now calculated that on energy consumption alone, they're paying back the cost of the installation in less than 12 months.

What are the technologies that compete with the Hydra-Cell?

All the pump types that you'd imagine – peristaltics, gear pumps, progressive cavity pumps, air-operated diaphragm pumps, piston pumps, vane pumps and centrifugal pumps. What we're saying is that where other pumps may not be suitable because they've got certain limitations, we've found successful applications. There are a lot of characteristics with the Hydra-Cell, which in the right combination have successfully replaced all of the above.

One of our strengths, both in the US and around the world, is in the machining and grinding industry. It has been discovered over the past few years that, by using high pressure coolant in machining and grinding operations, productivity can be increased dramatically. Speeds and feeds can be doubled and more in some cases. The high pressure coolant is recycled. Energy efficient Hydra-Cell pumps can pump this recycled coolant with minimal filtration. The gear, centrifugal and screw pumps traditionally used have cups, packings or seals and close running tolerances which require filtration down to less than 5 micron – an expensive filtration process. The Hydra-Cell pumps can pump fluids with particles up to 500 micron with no loss of efficiency! High pressure recycled coolant without expensive and problematic fine filtration.

As it's quite an unusual product, there must be a process of educating the customer as to its advantages?

We may call up a customer and they say "Oh, I needed an air-operated pump, or a gear pump, or a centrifugal pump." They may not even understand what the Hydra-Cell is. Introducing them to the benefits is one of our main activities. ■

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