

## Healthy down to the nearest millionth of a millimetre

Georg Fischer ranks among the nano pioneers of medical engineering

The surgeons climb into a submarine the size of a pin and set off on a voyage through the bloodstream. Their mission – to destroy a clot... That, at least, was what happened in the 1966 science fiction film “Fantastic Voyage”. Really just fiction? These days, the reality is not so far off. We already have a mini-pump that can travel through the arteries curing vasoconstriction, even without miniaturized surgeons on board.

The mini-pump is made of components that are not only very tiny, but also very reliable – thanks to GF Machine Tools – the Agie Charmilles Group within the Georg Fischer Corporation.



### **Miniaturization is no big deal. Precision miniaturization is**

The bloodstream is so narrow that the components of a vehicle that has to pass through it obviously have to be smaller than one millimetre. Yet they are still larger than one micrometre (one thousandth of a millimetre), which is the most common unit of measurement in precision engineering today. And they are definitely larger than one nanometre (one millionth of a millimetre), which is the unit of measurement now being targeted in the world of nanotechnology. Why this need for minuteness?

“Size tends to be the first thing that springs to mind when it comes to components,” says Ivano Beltrami, Head of Research at Agie Charmilles. “Although the real challenge is when a component has to be not just tiny, but precision-

made too, and when this precision-made component has to have a perfect surface finish as well.” A cogwheel of one metre in diameter might have to be accurate down to the nearest millimetre. By the same token, a cogwheel of just one millimetre in diameter has to be accurate in a range of less than one micrometre – meaning that we’re already fast approaching the nano range.

### **Extreme precision thanks to electric discharge machining (EDM)**

We know from our observations of the natural world that erosion is an incremental process. As the proverb says, “little strokes fell big oaks.” And in electric discharge machining (EDM), a field in which Agie Charmilles is world leader, the “strokes” in question are not axe blows, but electric sparks that mould or cut blanks. With up to three million sparks per second, EDM means not just constancy, but speed too.

Yet not even the finest spark in the world would do any good, if there were no precision mechanics to target it. “Every movement begins with a jerk, as a rule,” explains Ivano Beltrami. “In conventional mechanical engineering, this alone would be enough to rule out precision in the nano range. Our newly developed machines with their flexible structures, on the other hand, can transfer even the tiniest movement completely smoothly.”

Not only does precision of this order permit such developments as can help the human heart in situ, as it were, but the pooling of scientific ideas and information to which it gives rise also keeps the company’s finger firmly on the pulse.

## What it's all about

# A fantastic future for the fantastically small

The products of nanotechnology have enormous potential for economic growth and job creation, which is why researchers all over the globe are working frantically on innovative developments in this field. Among the leading nations are not just Japan, the USA and England, but Switzerland too, which is becoming more and more of a nano engineers' Mecca.

*David Ziltener, Nanofair Manager*

## The context

# Mega contacts thanks to nanotechnology

Leading role at TOP NANO 21	As a leading supplier of system solutions for the tool- and mould-making industry (with a 40% share of the world market for electric discharge machines) Agie Charmilles was a player of the first hour when the Board of Switzerland's Federal Institutes of Technology, with its sights set firmly on the 21st century, launched its TOP NANO 21 programme with the aim of "strengthening the Swiss economy by the development and application of new technologies based on the NANOMETRE."
A focus of interest at the Nanofair	The prototype of the electric discharge machine for the nano range was unveiled at the Nanofair 2003 in St. Gallen, where it attracted the attention of numerous international visitors too.
Interested parties from other fields too	Medical technology is just one of several nano fields. There is a clear demand for nanotechnology in electronics, optics, sensorics and the watch-making industry as well.

## The medical technology market in general

# A growth market in every respect

Global growth of 20% per annum	It doesn't always have to be nano. Agie Charmilles is present right across the board. Both with machines for the production of precision tools and moulds and machines which themselves perform specific operations within the production process.
End products in diagnostics...	For example: blood diagnosis rotors, microtest slides for DNA analyses, endoscopic scissors, burr-free needles for taking tissue samples – in particular in breast biopsy
...in regenerative surgery...	For example: implants, fixing plates, intervertebral disc replacement components or evaporation valves
...or in health aids	For example: hearing aids and inhalation equipment for asthma sufferers

## "Adding quality to people's lives"

# Miniaturization meets people's needs in two respects

Keyhole surgery instead of large incisions	The more medicine can home in on specific problem areas inside the body, the more superfluous major surgery becomes.
Efficiency to counteract the bottomless pit of healthcare spending	What has long held true for rich countries is all the more true for the world's poorer regions: Medical technology has to be not just possible, but affordable too. The more cheaply and efficiently the necessary treatments can be developed and produced, the higher our chances of maintaining high medical standards throughout the world.