SUPERCONDUCTORS BEARING GIFTS.

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Remember the fuss a few years ago about the discovery of high temperature superconductors? No?

These ceramic materials, which conduct electricity without any resistance at liquid nitrogen temperatures (-77C), were going to change our lives by providing cheap power, transport and communications.

That hasn't happened and high temperature superconductors have so far found use only in some highly specialised applications such as measuring minute magnetic fields.

But things appear to be changing. Superconductors could at last lead to cheaper energy - by performing as virtually frictionless magnetic bearings.

The principle is simple: any superconductor will repulse an exterior magnetic field - a phenomenon called the Meissner effect.

A superconductor, dipped in liquid nitrogen, and then placed over a powerful magnet will float, with no visible means of support, until it warms up and its superconducting properties disappear. It then settles on top of the magnet.

That means you could design a bearing by placing a magnet above a disc of superconducting material so that it floats over its surface but never touches it - which is just what US scientists at Argonne National Laboratory in Illinois have done.

John Hull and his colleagues have created the world's most efficient bearing, which operates at one-tenth of the friction created by the previous best bearing. This bearing will be the essential component of a flywheel system which can store energy required for power supplies.

The principal of a flywheel is simple: because more electricity is used during the day than at night, it can reserve any excess power produced at night and release it later when demand is high.

This is achieved because a flywheel is a disc which is spun at very high speeds by an electrical motor using the night energy. During the following day, the rotational energy of the wheel can be tapped, on demand, to release the power.

'The bearing has always been the Achilles heel of the flywheel storage system,' says Hull.

'The best conventional magnetic bearings, using an electromagnet, lose about 1 per cent of the stored energy per hour, whereas our bearing only loses 0.1 per cent,' he says.

The Argonne team is currently making laboratory models with a flywheel weighing 12 kilograms. However, they envisage building units weighing 40 tonnes that would provide 10 megawatt hours of power, and could be transported on the back of a truck.

Tune in to chips

DICK Tracy-style wristwatch telephones with TV screens may soon be a practical prospect, thanks to Australian scientists at the Centre for Gallium Arsenide Technology at the University of **Adelaide**.

They have designed a miniature television camera on a single microchip which could be used on a wristwatch for mobile communications such as phones, pagers and faxes.

The chip's circuitry, which covers about one-and-a-half square centimetres, replaces the entire TV camera,

including the vacuum tube and the lens as well as all of the processing components.

It is built from gallium arsenide, the wonder semiconducting material which has replaced silicon for many specialist uses, particularly those requiring fast processing.

According to **Derek Abbott** , the centre's deputy director, gallium arsenide provides the processing speeds required for a new imaging technique, called fractal compression, which is used to squeeze data into a narrow bandwidth for transmission.

Bug's eye view

THE same research team is developing a robot chip, the size of a drawing pin, that mimics the way insects see. The bug-eye chip, as the researchers call it, represents very large scale integration (VLSI) par excellence, incorporating 60 photodetectors, 60 parallel processing units, a digital processor and 22,000 transistors.

The chip does not produce complete images but captures the moving edges of objects just as insects do. 'Insects are very good at avoiding collisions,' says Abbott. 'A chip that can see like an insect could be used to the sameadvantage.'

The chip could help drivers to detect blind spots, or alert them to the danger of falling asleep at the wheel by monitoring head movements.

Other possible applications include a vacuum cleaner that cleans on its own, and a collision warning device for wheelchairs.

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