This girl's unusual necklace is made up of transparent hair-thin optical fibres

deposited as gases on the inside of a hollow silica tube at temperatures of around 2000°C. The tube is collapsed under intense heat to form a solid glass rod of about 1cm in diameter which already has the structure of the fibre which will be drawn from it. The rod is then loaded into a furnace, drawn into fibre and coated with a resin to protect it and increase its flexibility.

Lasers, tiny crystals the size of a grain of salt, are used to produce the light which carries information along optical fibres. This passes through a lens into the fibre. At the other end a receiver reverses the process and turns each light pulse back into an electrical signal. British Telecom has developed transmitters and receivers which are so small that together they could fit into a matchbox.

Joining two tiny strands of glass, whose cores measure just five-thousandths of a millimetre, is no easy task. But British Telecom's research team has devised an automatic machine that can align and fuse together the tiny cores to within a thousandth of a millimetre, resulting in virtually no signal loss – a performance bettered nowhere in the world.

Unlimited opportunity

The information society will find countless applications for optical fibres, from cable TV to security and surveillance, as well as a whole range of communications services in tomorrow's 'wired city' – home banking, armchair shopping, the classroom in the living room and more besides.

Optical fibres are the key to probably the biggest breakthrough in communications since a Scotsman invented the telephone over a century ago.

TELECOM TECHNOLOGY SHOWCASE

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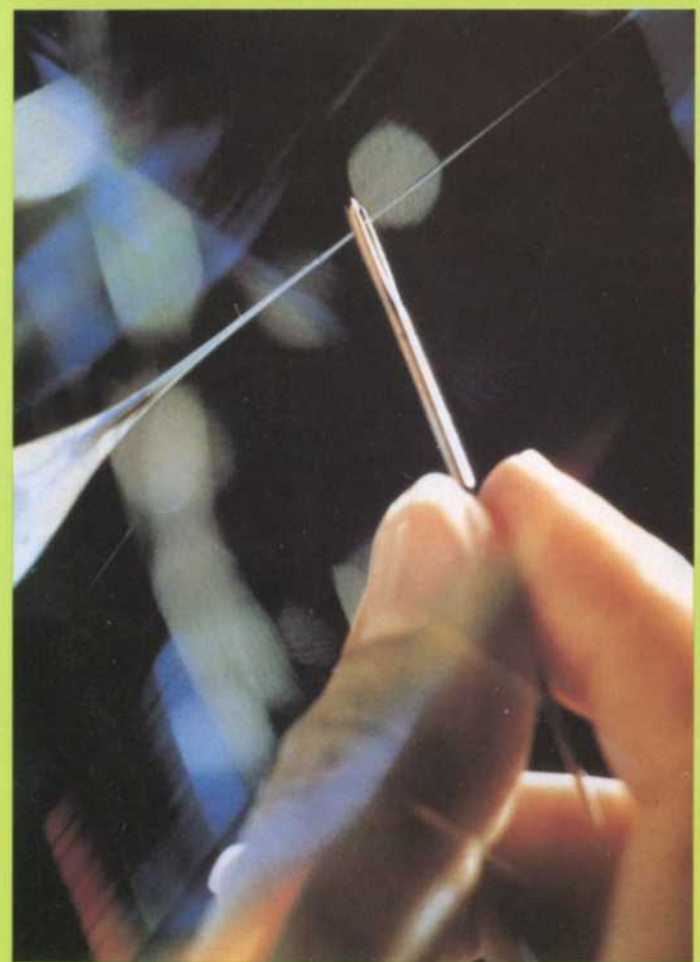
The Telecom Technology Showcase

Optical fibres



Optical fibres

Optical fibres – hair-thin strands of extremely pure glass, carrying information as pulses of light – are transforming the world of telecommunications and shaping tomorrow's information society.

They are made from glass so pure that a block of it 20 km thick would theoretically be as transparent as a window pane.

Dozens of fibres – carrying around 100,000 telephone calls – could all pass through the eye of a needle at the same time. Each strand consists of an inner core to channel the light and an outer cladding to keep it in by reflecting it back along the core.

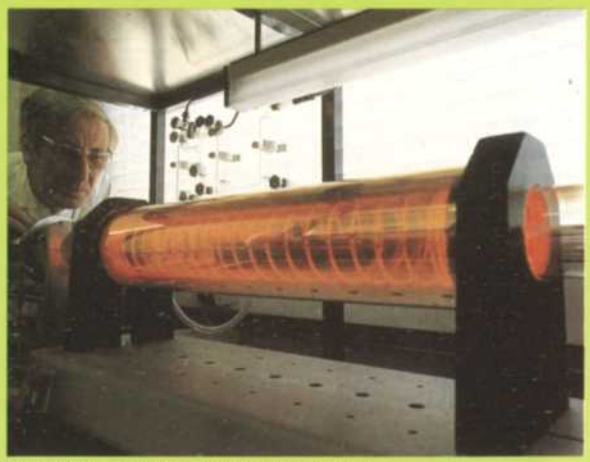
The advantages

Glass and light make an unbeatable combination. They are bringing cheaper, more reliable communications and making possible entirely new services at home and in the office. In every way, optical fibres have the edge on the metal wires they are supplanting.

Potential The information carrying capacity of optical fibres is immense – far greater than any foreseeable demand. An optical fibre cable the thickness of a finger could bring a hundred TV channels into people's homes.

Flexibility All kinds of communications can be carried along the same optical fibre cable – pictures, drawings, text, voice, music, computer data, or any other transmission requirement of the information society – at higher speeds than have previously been possible.

Performance Light passing through the core of a glass fibre can fade less rapidly than electricity along copper wires. Early in 1982, British Telecom's researchers at Martlesham Laboratories, in Suffolk, achieved a world first by transmitting light signals over a distance of more than 100 km without any amplification.



Laser chips, made in this gold-plated furnace, are used in optical fibre transmission

Cost The raw material for optical fibre (sand) is cheap and abundant. Because equipment can be housed in exchanges or other buildings, rather than in manholes under the road, the system becomes a lot cheaper and easier to maintain.

Size Optical cables are small, light and easy to handle. They can carry the same number of telephone calls as metal cables nearly ten times as thick. A pair of optical fibres in use today carries 2,000 simultaneous telephone calls.

Quality Optical fibres are immune to electrical interference which affects the quality of calls.

Security It is extremely difficult to tap information being carried through optical fibres. The only way is by the easily detectable process of breaking the cable.

The digital connection

Optical fibres have a key role to play in the digital revolution sweeping through telecommunications. Simply, this means that all information is handled as separate rapid pulses, rather than a continuous electrical wave. The old analogue, or waveform, method was fine for speech but is inadequate for the high speeds at which today's computers, terminals and office machines work.

All information can be translated into bits (short for BInary digiTS, the language computers have always used). These bits are the basic unit of communications and can easily be represented as pulses of light.

Optical fibres are ideal for digital working and open the door to a whole host of services not possible on an analogue system. British Telecom's research laboratories have a working system which can carry 565 million bits a second through a single fibre (the equivalent of 8,000 simultaneous telephone conversations) and the technology has by no means reached its limit.

From laboratory to customer

Serious efforts to solve the practical problems of communicating with light began in the 1960s with Britain among the world's pioneers. Work at British Telecom's research laboratories began in 1966 and in 1970 a separate optical communications division was set up. The move out of the laboratory came in 1977 with the setting up of the first working system in Europe to carry telephone calls over a distance of 13 km between Martlesham Heath and Ipswich.

British Telecom's customers in the Midlands became the first in Europe to make calls by light in September 1980, when the first link in the public optical fibre network was opened.

During 1980, optical fibre was laid under water for the first time in the world in Loch Fyne on the west coast of Scotland.

The network grows

British Telecom is now creating the world's most comprehensive optical fibre network. By the end of the decade at least 100,000 km of fibre will have been installed, linking all of Britain's major cities. Optical fibres will then account for half the capacity of the trunk network.

Above the ground ... A few systems, particularly in Wales, run overhead through rugged country, demonstrating the attractions and versatility of optical fibres where the cost of installing a duct system is prohibitive.

And under the sea ... Optical fibres will be particularly important for the undersea cable system. Technology using coaxial cables has reached the point where no further significant cost reductions are possible. Using optical systems, big savings are expected. The first optical fibre cable between Britain and the USA could be in use by the end of the decade.

The technology

To make the glass for the fibres, the ingredients are