Invention

Talking Binoculars

The United States Army has a new weapon in its electronic arsenal—a pair of binoculars. One of the barrels of this new instrument is rather ordinary; it contains a set of lenses. The other houses a sophisticated radio transmitter and receiver that connects to a head set. On a battlefield, the operator uses the optical barrel to spot a distant colleague and the transmitter to talk to him.

The radio's extremely high frequency—70 billion cycles per second—provides such a narrow beam that unless the listener is in the line of sight he cannot hear the transmission. To reply, he uses his own binocular transmitter. Range: about five miles. Eavesdropping: nearly impossible.

3-D Display

A bright sphere of light hovers in midair, bathing the darkened laboratory in a ghostly red glow. This floating image is no apparition; it is created by thousands of tiny lights on a spinning panel built by scientists at the Massachusetts Institute of Technology. Their major goal: to reproduce detailed three-dimensional pictures of the interior of the human body.

In the past few years, sophisticated medical scanners have made it possible for doctors to peer deep inside the body. The CAT (computerized axial tomography) scan, for example, uses x-rays to produce a series of cross sections of a part of the body. These layers have to be studied one by one on a video screen. A physician preparing for surgery can spend hours examining hundreds of slices, trying to assemble them mentally so that he can visualize, say, a tumor in its entirety. But not until he operates can he actually see the size, shape, and exact position of the growth.

The sphere suspended in space at MIT is produced by a device that should change all that. Invented by engineer Ed Berlin in 1975, when he was 17 and a freshman at MIT, the new 3-D display is fed by a computer that can organize data from the hundreds of layers of any organ being scanned. The computer feeds the information into the display, a small panel studded with 4,096 light-emitting diodes. The panel spins 20 times a second, and the diode pattern changes 256 times a spin. Each new pattern represents a different layer of the real object, but because the panel turns so fast, the eye perceives all 256 patterns at once—a shimmering reproduction with length, depth, and width. Because each diode can shine with 15 degrees of brightness, observers can easily tell the difference between various parts of the body; for example, a doctor would get the impression of peering through a bony skull (black) and brain tissue (pale red) to see a malignant tumor (bright red).

The MIT team, directed by engineer David Jansen, is now using the device to display simple solids: spheres, cubes, tetrahedrons, and pyramids. It will be hooked up to a CAT scanner for interior 3-D views of human beings as soon as the engineers find a hospital to participate in the project. Eventually, says Jansen, it may even be used to display sonar and radar signals that reveal the location of subterranean oil pools.

Sheep to the Rescue

People saved from burning buildings may, in the near future, have cause to be grateful that Australian sheep are finicky. About eight years ago, two Australian entrepreneurs decided to create a feed additive for sheep by grinding up parts of eucalyptus, tea trees, and other plants that wild animals find delectable. But sheep, it turned out, would not touch the stuff. By then, though, the pair had discovered that Australian aborigines used many of its ingredients to soothe burns. When they made the ingredients into a gel, they found it could put out the fires that caused the burns.

Their discovery is now being marketed in the form of the Water Jel Fire Blanket. To make it, they soak a wool blanket in the gel until it absorbs 13 times its own weight of the stuff. A fireman attempting to save someone whose clothes are in flames has only to wrap him in the blanket. The gel smothers the fire and penetrates the victim's clothes to keep the skin moist and cool, reducing the loss of body fluid caused by burns. The producers have thought of everything; because burn victims are prone to infection, the blanket comes packed in a sterile container. The gel-soaked fabric gives excellent protection to a person running through flames, so fire departments, the Coast Guard, and other rescue organizations are hoping that the new product will help them put a wet blanket on some exuberant fires.

Live from Dartmouth

While teaching a course on microscopy a couple of years ago, Dartmouth biologist Robert Allen told his students that using crude television cameras to photograph the rapid movements of tiny and intricate cells was "a little like trying to cram an elephant into a Coke bottle." Then, about to demonstrate his point with a television camera rigged up to shoot through a microscope, he accidentally turned the wrong dial and flooded the cell under his lens with light. The brilliance eliminated contrast between the specimen and its background, erasing the view of the cell under the

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Protected by a Water Jel fire blanket, a test subject emerges from a fire walk

lens. But the cell's pulsating image showed up with stunning clarity on the TV screen. "I was shocked," recalls Allen. "I tucked the experience away and decided to check it out."

Now, having done just that, Allen has found a way to reveal in great detail a vivid world in which blood platelets simmer like geyser pools, and tiny bodies within the cells travel through fibers like traffic on a freeway. The trick, he revealed at a November meeting of the New York Microscopical Society, is to team a special light-processing television camera and a powerful optical microscope.

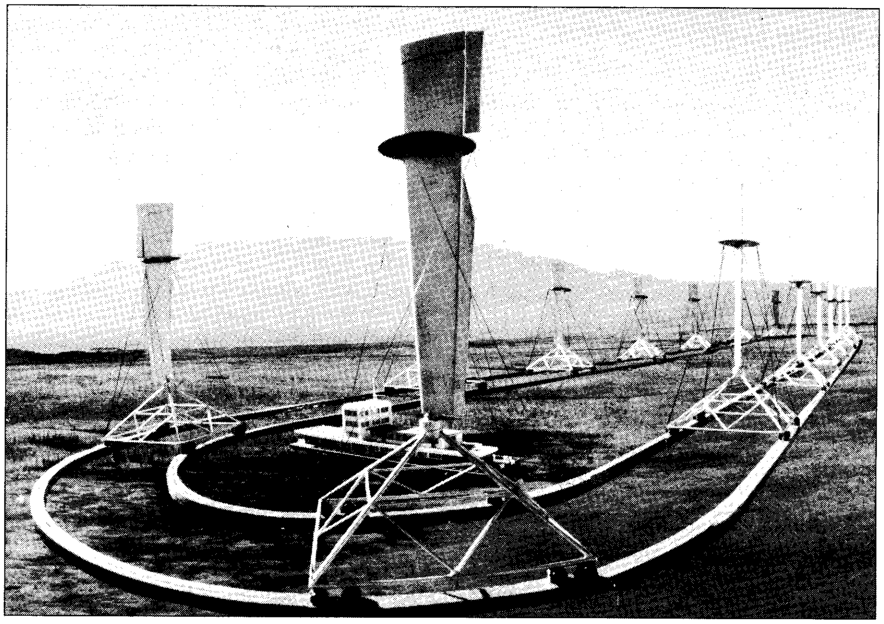
The system, which Allen developed with the help of his wife, Nina, also a biologist, works on simple principles that "somehow went unobserved for years." He explains: "When we set up the microscope for visual observation, we normally arrive at a trade-off between high contrast with the aperture closed and high resolution with the aperture open." This trade-off results in light insufficient for conventional cameras to catch rapid movement. But a TV camera offers a way around that obstacle because it transforms light from the image under the microscope lens into an electric current. By modifying that current, Allen found that he could reduce light in the background of the image without lessening the brightness or contrast of the specimen. His invention allowed him to video-tape moving cells with high resolution and contrast up to 10,000 times as fast as before.

Electron microscopes have a thousand times as much power as Allen's video version, but they cannot provide an image of moving cells; the cells must be killed and placed in a vacuum to be scrutinized under a beam of electrons. Used in tandem with the Allens' new system, however, electron microscopes will provide important information on the motile cell. "Sometimes we see particles moving, but we don't know what they are," explains Allen. "If we examine them under the electron microscope afterwards, we can usually say, 'Aha! That was a thus-and-such under a thingamajig.' "

Allen is using his microscope to study microtubules—spaghetti-shaped fibers that support the cell the way bones support the human body. His recent video tapes reveal that microtubules, once thought to be immobile, actually snake through the cell, apparently part of the mechanism that sends messages from one nerve cell to another. Allen believes that is just one of many revelations his invention is certain to bring.

Ships of the Desert

Laird Gogins was once a man of modest ambitions. He simply wanted to invent the fastest sailboat in the world. So he devised a new way of rigging a sail—and found that what he had built was indeed fast. Alas, it was not seaworthy. "The day I tested the boat, there were eight-foot waves on the Great Salt Lake. The boat capsized. The water was freezing. By the time I was rescued and reached the hospital, my temperature was down to eighty-six degrees." Undaunted, inventor Gogins came up with a grander idea: instead of powering one small boat with sails, why not an entire city? "I decided to drop the boat and design the world's largest wind-powered generator," he says.



Model of wind turbine superimposed on its future site

Gogins's invention is no ordinary windmill. The free-wing turbine, as he calls it, will consist of 14 giant sails, each 200 feet high and mounted on a wheeled cart. The sails will propel the carts around an oval railway half a mile long. The rolling wheels of the carts will drive electric generators.

Ground-breaking for the first free-wing turbine will begin next summer on a barren tract near Salt Lake City. Gogins expects that the privately financed project will be completed by 1984 and will produce enough electricity to power a city of 80,000. "That's twenty times as much power as all the government's windmills put together," Gogins claims. How is that possible? "We don't get any more power per square foot of wind intercepted than a windmill gets. But our sails intercept a great deal more wind, because of the height of the sails and the length of the track." Computerized machinery will set the sails to the varying wind direction; no shouts of "Ready about!" or "Hard alee!" will be required.

Detecting Deafness Early

A newborn baby from the Hillingdon section of London squirmed in a crib while sensors buried in the foam mattress measured his every motion. When the sensors had established a pattern, recorded on a microprocessor, they set off a series of beeps. The child continued to wriggle in the same pattern. To Michael Bennett, the implication was clear: the baby was deaf.

After hundreds of similar tests, engineer Bennett, a professor at Brunel University in England, is ready to market his auditory-response crib, a device that is 97 per cent accurate in detecting deafness in newborn babies. Bennett contends that the new crib "will end considerable human misery" by alerting parents as early as possible to a baby's deafness. "The best time to teach lip reading or install a hearing aid is at six months," he says. At that age, children learn more easily than they do later to recognize exaggerated lip movements or—in the case of the partly deaf—crude rhythms and sounds.

Bennett claims that the new crib can also detect ailments that are characterized by sluggish reaction: respiratory problems, brain damage, poor muscle tone, even jaundice. ■