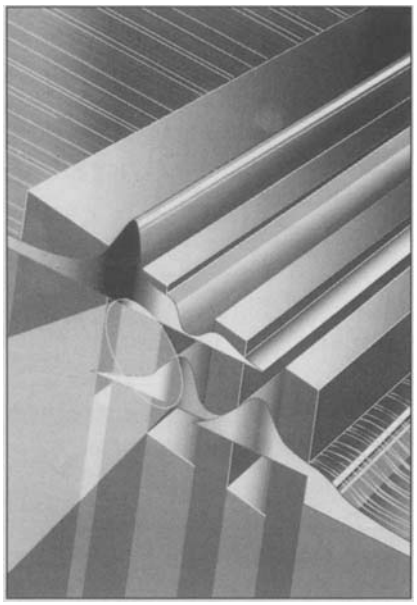
AT&T INNOVATION BRIEFS

Innovation Briefs are summaries of recent discoveries and developments within AT&T Bell Laboratories. Patents To Build On call attention to AT&T patents that may have commercial potential. Those wishing further information, or AT&T readers who would like to contribute future items, are encouraged to contact the AT&T Technical Journal *editor.*

Quantum Cascade Semiconductor Laser Invented



The quantum cascade (QC) laser operates like an electronic waterfall. When an electric current flows through the QC laser, electrons cascade down an energy staircase; every time they hit a step they emit an infrared photon, or light pulse.

Researchers at AT&T Bell Laboratories have invented the world's first laser that can emit light at a specific wavelength set at nearly any point over a very large range from the mid- to far-infrared spectrum. Called a quantum cascade (QC) laser, the new device is capable of operating over a much broader range of wavelengths, compared with a conventional semiconductor laser. When an electric current flows though the QC laser, electrons cascade down an energy staircase; every time they hit a step they emit an infrared photon, or light pulse. At each step, the electrons make a quantum jump between well-defined energy levels. The emitted photons are reflected back and forth between built-in mirrors, stimulating other quantum jumps and the emission of other photons, until the amplified pulse escapes the layer cavity. The QC laser's emission wavelength is determined by quantum confinement effects: its layers are so thin — typically a few nanometers, or about 100 billionths of an inch — that electrons are squeezed and change their quantum-mechanical properties. The laser's wavelength can be continuously adjusted, over a broad range, by changing layer thicknesses. Lasers operating at such wavelengths have many potential applications, including environmental monitoring of air quality, industrial process control, and free space point-to-point communications. Conventional semiconductor lasers, widely used in such applications as lightwave communications and compact disk players, operate at wavelengths from the near-infrared to the visible.

A Directory-Assistance Preprocessor Using Speech Recognition

In recent years, automatic speech recognition has enabled AT&T to automate several "operator assisted" functions, most notably 0+ calls. A logical next step is automation of directory assistance calls. Although the general problem of automatically recognizing a spoken name remains a challenge, it is possible to automate the front-end processing of directory assistance; that is, determination of the city for which the assistance is required. For such a preprocessor, the speech-recognition task is to determine which of the 1,000 or so cities associated with a given area code is desired. This recognition task is difficult because most city names are uncommon words, and pronunciation is highly variable among users. The recognizer that has been used for city-name recognition is based on context-dependent subword units, and uses both a pronouncing dictionary and statistical rules to represent the most common pronunciations of city names. The entire city-name recognition system is implemented on a Silicon Graphics Inc. Indigo R4000 Workstation, and recognizes spoken city names in psychological real time (within a second or so after speaking). Using a set of 1,200 city names from New Jersey, the recognition accuracy was over 95 percent on a test of 2,400 names spoken by 100 talkers in an off-line (non-real-time) evaluation.

Patent To Build On

On-Line Documentation Facility

In a particular realization of this invention, users of an on-line documentation facility can specify modifications to documents that would otherwise be provided by the system. Users who do not specify any modifications receive the standard on-line documentation as a default. Inventors: J. M. Ackroff, M. J. Heffler, and J. C. Mitchell. (US Patent No. 4,800,485)