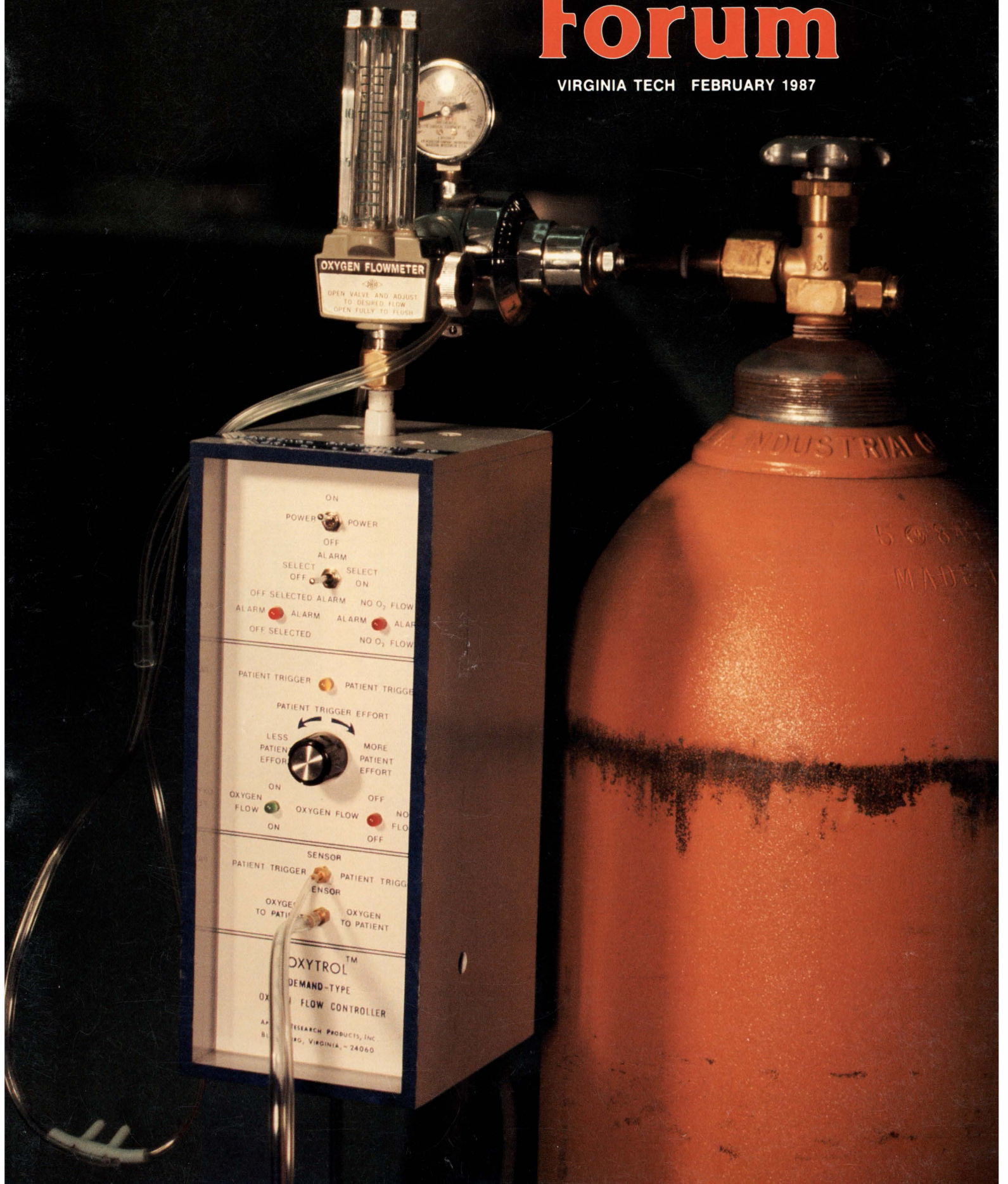


# Engineers' Forum

VIRGINIA TECH FEBRUARY 1987

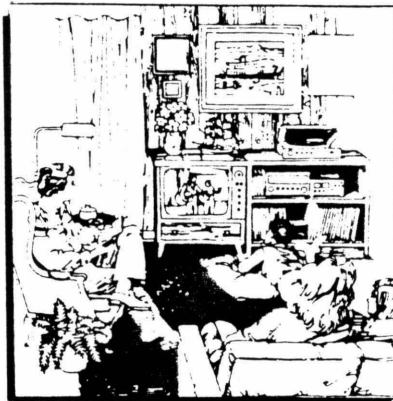


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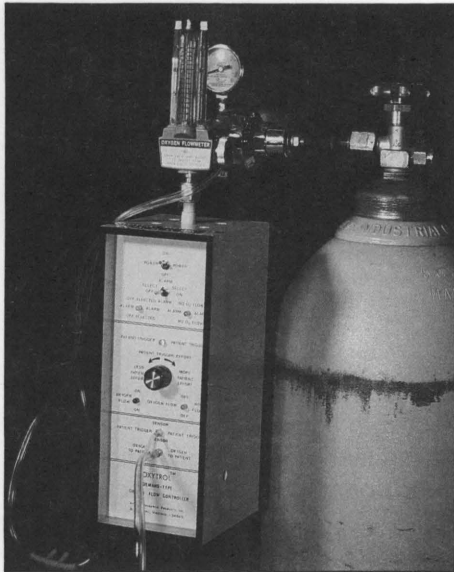
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# Engineers' Forum

Volume 5, Number 3  
February, 1987



On the Cover:  
Dr. Arp's Oxygen Flow Controller reduces rising medical care costs.

Photograph by W. Bruce Robertson

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## Side Effects of Technology Threaten the Engineering Profession

The space shuttle Challenger and Three Mile Island have one thing in common — disaster struck when responsible decisions made by engineers were overruled. As technological growth accelerates, we must govern it to ensure that it continues to serve mankind. This growth can be governed most effectively by those who understand and respect it most — the engineers who created it.

It would seem logical, then, for engineers to become politically and socially active. Unfortunately, this seldom happens. An engineer who blows the whistle when he observes an unsafe practice is often demoted or fired. Perhaps the real tragedy is that engineers have to accept this form of corporate retribution since they aren't sufficiently unified to protest effectively.

The professional responsibility of engineers is increasing dramatically. Modern technology has frequent and often harmful social, economic, environmental, and political impacts. In the words of Dan H. Pletta, Professor Emeritus of Engineering, "technology, like surgery, is not risk free. But unlike surgery, technology involves innocent bystanders if 'side effects' follow its application." And unlike the medical profession, all engineers are not members of a unifying organization that provides standards of ethics to work by, reprimanding those who do not follow the code.

The Order of the Engineer is a movement to emphasize professional obligations of engineers to serve their fellowman. Its purpose is to unite engineers of all disciplines to foster pride, integrity, honor, and dignity. It encourages engineers "not only to protect the public's health, safety, and environment and to conserve its resources, but to participate in societal leadership roles on technological issues."

Engineers join The Order of the Engineer voluntarily, and with only a \$10 fee for the ring received. They give an oath to "hold paramount the safety, health, and welfare of the public in the performance of professional duties" similar to the Hippocratic Oath medical professionals have been giving since the 4th century A.D. "It neither replaces nor competes with other engineering societies, but it does lend dignity and significance to the professional service of those who accept its creed."

If you would like to join this widely recognized movement, ceremonies will be held this year during National Engineers' Week, the last week in February. For more information, please contact Dr. Comparin, 113 Randolph, Dr. Conger, 135 Randolph, or call the *Engineers' Forum*, 112 Femoyer, at 961-7738.



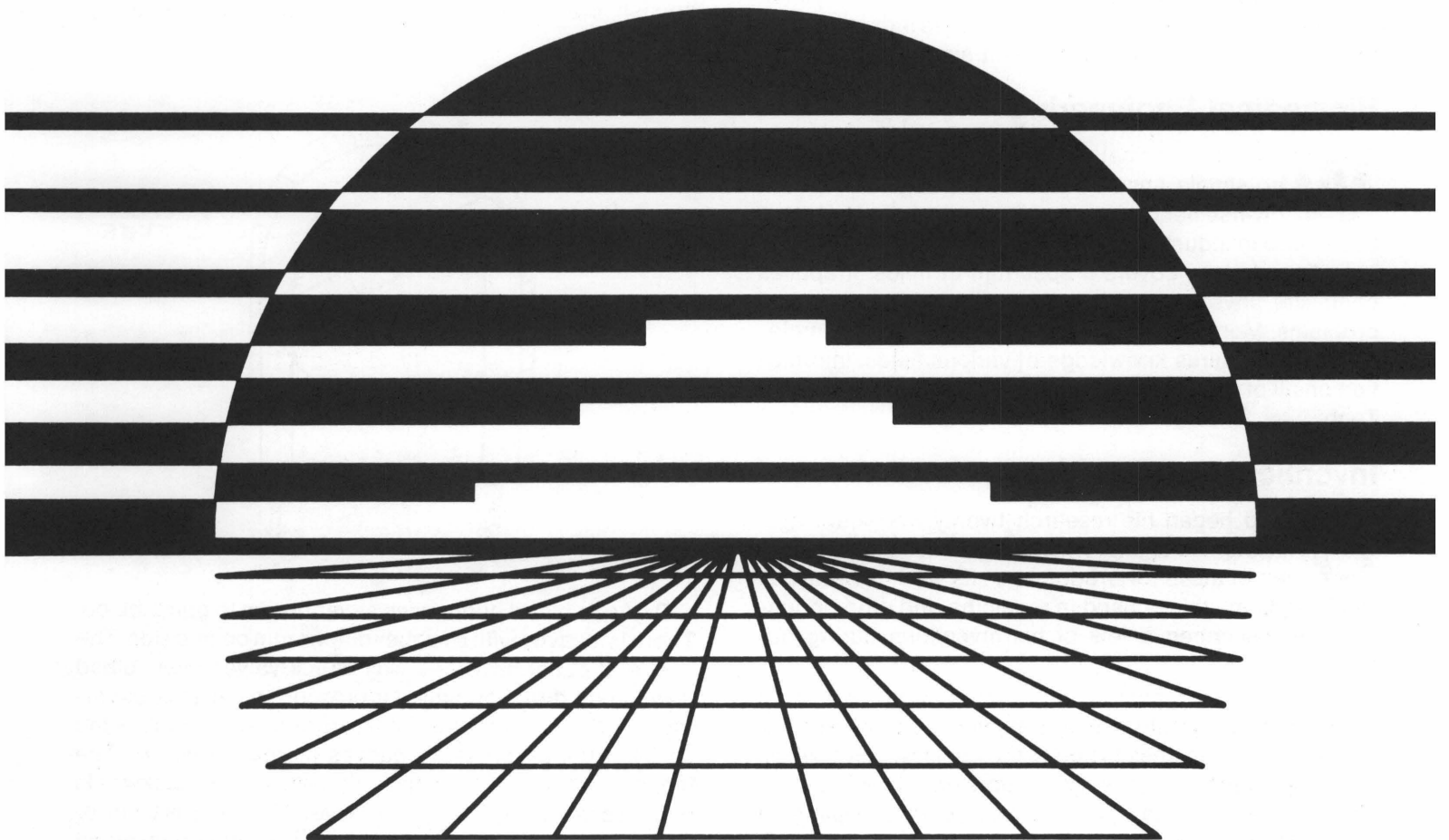
Alex Derr  
Editor

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# BIOMEDICAL ENGINEERING:

## A Practical View

by Rajiv Khanna

**D**eep in the dark lower recesses of Randolph, where many students dare not go, is the office of Dr. Leon Arp. His office hides in room 3 of Randolph's basement. It is an ominous place for a leader in Biomedical Engineering. Who would suspect that this is the home of eighteen patents and numerous innovations? When you enter room 3, you enter both a laboratory and an office. Electronics and mechanical equipment cover the counters. A table sits in the middle. Papers cover the surface in neat arrays. In the center of it all is Dr. Arp. This is Dr. Arp's biomedical engineering. It applies modern technology to real world problems. Problems are opportunities to apply technology. The world is full of them. Many problems have simple solutions. Some problems are not even recognized as problems. The creative individual recognizes a problem and then finds a simple solution.

### Biomedical Engineering

**W**hat is biomedical engineering? This question has no simple answer. Biomedical engineering is a diverse field. It involves many disciplines. Dr. Arp has a Ph.D in Industrial Education. His work, shown in the inventions below, covers a spectrum of fields. It applies chemistry, physics, mechanics, and electronics to medical problems. Most solutions are common sense. The implementation requires knowledge of various fields. Information on all of these subjects is readily available at Virginia Tech.

### Inventions

**D**r. Arp began his research twenty-five years ago. He patented eighteen inventions and licensed fourteen of these for production. His work is practical. He designs machines used in medicine and other industries. He described a few of his inventions during our interview.

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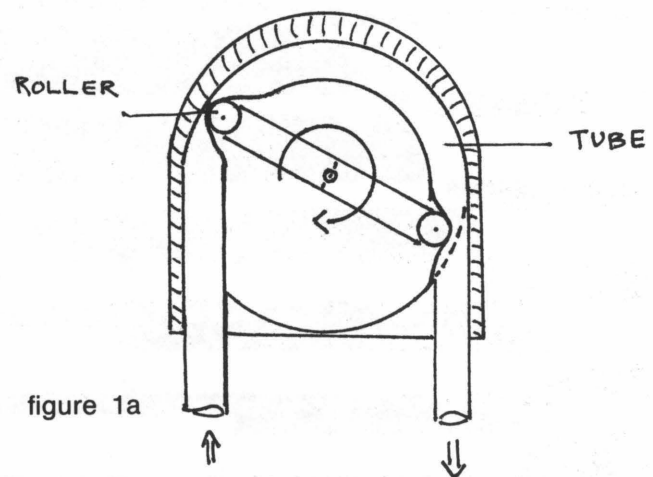
*Rajiv Khanna* is graduating in June with a BS in Electrical Engineering. He hopes to spend the next few years studying Digital Signal Processing in a more urban setting. Quite the sports maniac, Raj spent this football season filling out graduate school applications. But only during the commercials.

### Oxygen Flow Controller

The oxygen flow controller saves money. It reduces the amount of oxygen wasted when a person exhales. People inhale for only one third of the breathing cycle and exhale for two thirds of this period. The oxygen flow controller turns the oxygen supply on during the inhalation part of the breathing cycle and off during exhalation. It reduces oxygen loss during the exhalation period saving hospitals money.

### Blood Pump

Other medical problems yielded new patents. The blood pump is another example. The roller and tube pump uses a roller to pinch a tube carrying blood. The blood moves when the roller squeezes the blood from one end to the other (see figure 1a). The squeezing action crushes blood cells. "Would you expect that a steam roller would not squash a basketball?" Dr. Arp asked. "It's all common sense!"



Dr. Arp's blood pump uses a diaphragm to pump blood. There is a cavity with a rubber diaphragm on one side. The inlet and outlet have one way check valves allow blood flow in one direction only. Air pressure moves the diaphragm. A vacuum pulls the diaphragm out and blood fills the cavity. Then air pressure pushes the diaphragm in. The blood flows out of the cavity. It cannot flow backwards because of the one way check valves. "The trick is to never let the diaphragm touch the cavity walls (and crush blood cells)" Dr. Arp explained.

### Blood Oxygenator

Blood pump damage only accounts for fifty percent of the damage to blood during surgery. The other half of the damage stems from blood oxygenators. Bubbling pure oxygen through blood damages red blood cells. Separating the blood and oxygen with a membrane reduces the damage. Oxygen diffuses through the membrane into the blood the same way it does in the lungs. Blood often sticks to the membrane reducing oxygen diffusion. The blood must flow at high speed to keep it from sticking. This damages the blood.

Dr. Arp's blood oxygenator pumps the blood laterally across the oxygen carrying tubes. The natural flowing action around the tubes washes blood away from the membrane. More oxygen reaches the blood and there is less damage.

Dr. Arp's research interests vary from motor controllers to ovulation detectors. A video tape is available that describes many of his inventions. Each invention serves a useful purpose and helps people. This is common to all of his research.

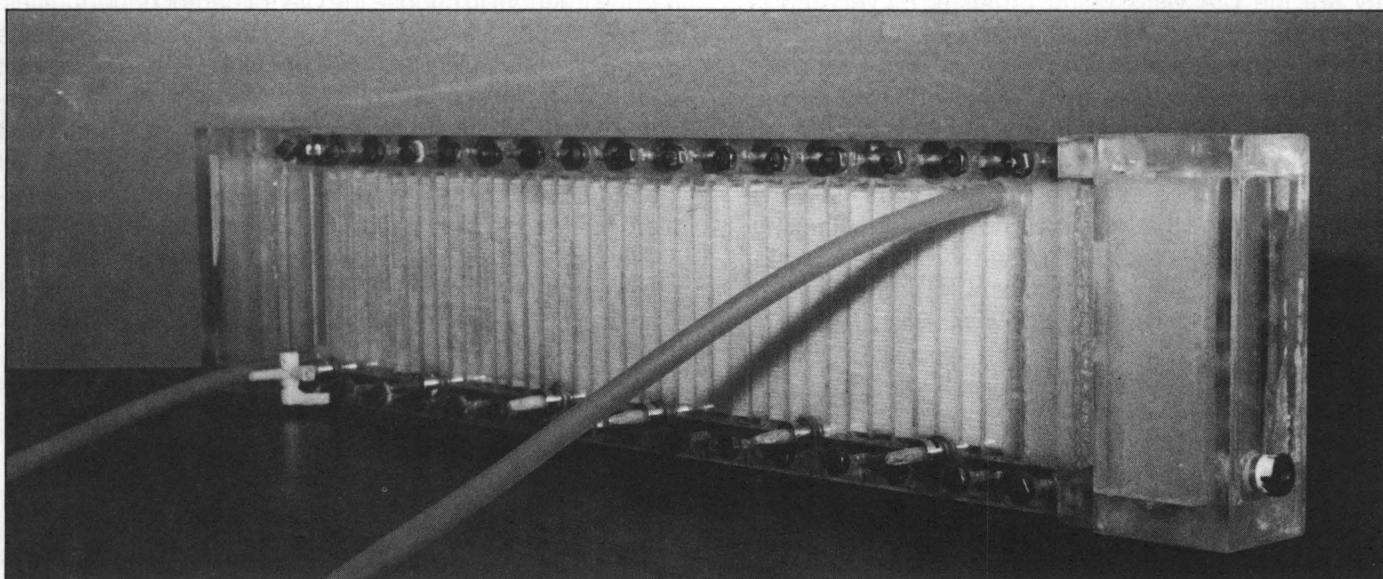
### A Piece of Advice...

**D**r. Arp gives his graduate students a piece of advice. Find your own solutions first and then research the work of others. Hybridize the best of both and solve the problem. Don't let others hinder your creativity. If biomedical engineering interests you, Dr. Arp is available to answer questions. He encourages undergraduate research.

He teaches the following courses in the mechanical engineering department at Virginia Tech:

- ME 3100 Introduction to Biomedical Engineering
- ME 3270 Biomedical Instrumentation
- ME 4420 Biomedical Systems Engineering

Dr. Arp recommends ME 4420 as a course in applied digital electronics to all engineers. These courses are available as technical and free electives to most engineers and apply to the biomedical engineering option available.



# The CIA

## Recruiting . . .

by Christine Muller

**S**hould the CIA be invited to college campuses for the purpose of graduate recruitment and career opportunity information? This issue is attracting a great deal of attention as the CIA is currently on a national tour of various universities. Opposition has been met on several campuses, including Virginia Tech on December 2, 1986. The College of Engineering extended the invitation to the CIA and the visit was sponsored by the Student Engineers' Council. The seminar addressed the topics of "The Role of Intelligence in a Democratic Society" and "The Role of Engineers and Scientists in the CIA." Attention was drawn to the visit by both students genuinely interested in career information with the CIA and students protesting CIA representation on campus.

Why are the CIA visits being protested? Everyone is aware that the First Amendment guarantees all citizens the right to freedom of speech. This implies a right for each individual to make his or her own decision. By organizing demonstrations which are disruptive and immature in nature, protesters are violating the human rights of fellow students and CIA representatives. The protesters make the incorrect assumption that others are not capable of making their own intelligent decision based on varied backgrounds and unique life experiences. CIA protesters feel that it is their right and responsibility to inform the public of

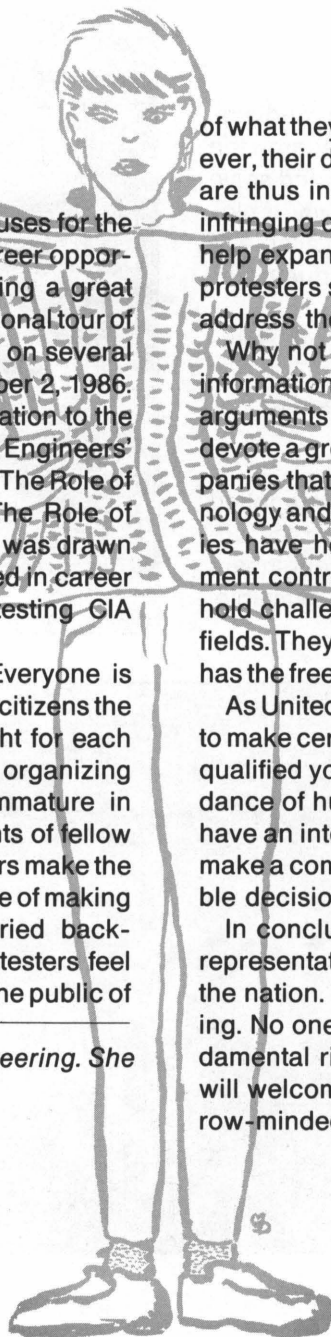
*Christine Muller is a senior in Materials Engineering. She is Vice President of the SEC.*

of what they feel are controversial actions of the CIA. However, their demonstrations come across as a nuisance, and are thus ineffective in expressing their views. Instead of infringing on CIA visits extended through the university to help expand career opportunities for graduating students, protesters should extend their own invitation to the CIA to address the separate issues that interest them.

Why not protest other companies that recruit and hold information sessions on campus? To act consistently with arguments that CIA protesters have, they would have to devote a great deal of time opposing many influential companies that recruit at Virginia Tech. Due to trends in technology and shifts in government spending, many companies have heavy percentages of defense related government contract work. The employees of these companies hold challenging and rewarding careers in their selected fields. They have the freedom to choose this as any person has the freedom to choose the CIA for career opportunities.

As United States citizens, it would be in our best interests to make certain that the CIA has access to some of the most qualified young people. College campuses offer an abundance of human talent and resources. Those people that have an interest in a challenging position with the CIA will make a commitment to enact conscientious and responsible decisions in both their job and the future of the CIA.

In conclusion, there are no qualified reasons why CIA representatives should not visit college campuses around the nation. The basis for educational institutions is learning. No one should interfere with this purpose or the fundamental right for freedom of expression. An open mind will welcome increased knowledge and will prevent narrow-minded options for the future.



Matthew Dawson

# on Campus: or Subverting?

By Mary Anne Lonergan and Susan Talbot

**A**fter World War I, the CIA was created to be a fact finding organization, basically to report information to the federal government. The original Legislative charter in 1947 states that the CIA has the authority to "perform such functions and duties related to intelligence affecting the national security as the National Security Council may from time to time direct."

It is this phrase that many feel the CIA has abused and consequently has brought them justifiable mistrust by a large portion of the public.

In the past 35 years, the CIA has been involved in plots to overthrow and subvert governments in Iran, the Sudan, Syria, Guatemala, and Chile, among others. Many feel that when a foreign government has begun leaning toward socialism, the CIA has implemented "questionable tactics" to replace the government in power. By "questionable tactics" one means assassinations, espionage, torture, and propaganda. These claims against the CIA are not futile words.

In Cuba in 1961, the CIA attempted to assassinate Fidel Castro, seeking the aid of Mafia Figures to arrange his murder. Six more attempts were carried out in the next two years. The CIA was directly involved in shaping the history

*Mary Anne Lonergan is graduating this June with a BS in Math. She likes food, art, and people.*

*Susan Talbot is also graduating in June, but with a degree in Communications Studies. She hopes to attend graduate school and study puns.*

of the Viet Nam War. Using techniques of terror, assassination, kidnapping, and intimidation against the Viet Cong Leadership, the CIA implemented their "Phoenix Operation" unbeknownst to the South Viet Nam government. In 1971, William Colby, CIA director, revealed that over 20,000 suspected Viet Cong were killed under Phoenix within three years.

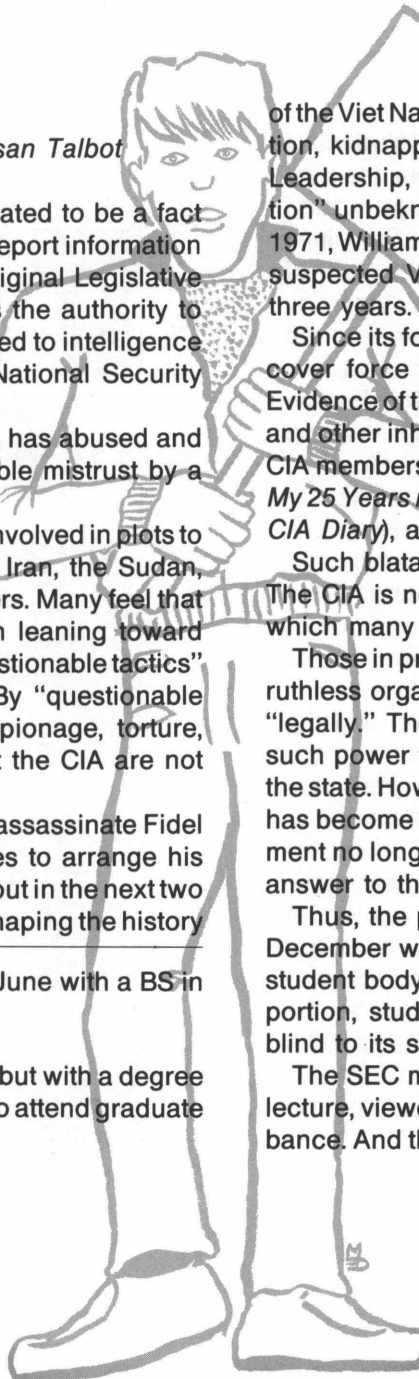
Since its founding in 1947, the CIA has been the undercover force in the overthrow of selected governments. Evidence of this and their engagement in torture, sabotage, and other inhumane tactics have been revealed by former CIA members such as Ralph W. McGhee (*Deadly Deceits, My 25 Years in the CIA*), Philip Aghee (*Inside the Company, CIA Diary*), and by conscientious news reporters.

Such blatant facts support the protest against the CIA. The CIA is not the polished and patriotic team of G-men which many seem to envision.

Those in protest regard the CIA as an overly empowered, ruthless organization, capable of destroying human lives "legally." The U. S. Government entrusted the CIA with such power for the purpose of protecting and defending the state. However, the CIA has exploited this intention and has become so large and extensive that the U. S. Government no longer can control it. It seems the CIA only has to answer to the CIA.

Thus, the protesting of the CIA at the SEC meeting in December was not some banal rebellion. A portion of the student body is aware of the CIA's lawlessness. Another portion, students interested in working for the CIA, are blind to its subversive actions.

The SEC members, along with those who attended the lecture, viewed the protesters as an uncontrollable disturbance. And this is exactly how the protesters saw the CIA.



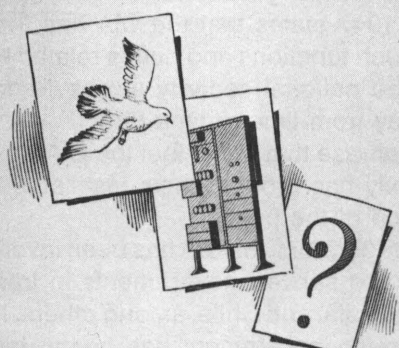
Matthew Dawson

# Sixty Years Ago

Editors Note: This editorial appeared in the January, 1927 issue of the *Virginia Tech Engineer*

It is the duty of every thinking engineer, or student of engineering, to eliminate, as far as it is possible, the very hazy and indefinite conception held by the average outside individual concerning engineering. At the present time, people are beginning to realize more and more the worth of the engineer as a professional man; still, there are yet many people who confuse the mechanical engineer with the engineman of a locomotive or make some other equally absurd mistake. Undoubtedly, the engineering profession is becoming more recognized and the engineer is being placed with his friends, the doctors, lawyers, etc. This placement is inevitable. The engineer, in his own particular sphere, is doing just as great work and doing it just as well as any other class of men. Often the monetary returns are small — indeed, it has been said that one never finds a rich engineer. The engineer's contribution must be advancement of the world and to the progress of his fellow man. His gifts to humanity are priceless.

It is on account of the works of the engineer that the student of engineering should take a particular pride in the maintenance of the standards set for him by his predecessors. He should realize that his position in life is a peculiar one; that unless his achievements are of particular brilliance, that they will never be known except to a select few. You can find many people who can tell you who wrote *Evangeline*, but there will be few indeed who can tell you who designed the Brooklyn Bridge. Still, with regard to service to humanity, the Brooklyn Bridge is by far the greater achievement. Everything considered, however, the engineer has the consolation of knowing that his work is practically permanent. His constructive efforts are monuments of his lifetime.



**Carrier pigeon  
to carrier current  
—and then some!**

**I**N the field of communication great strides have been taken—and greater will be taken. And just as the carrier current in telephony is an infinitely better vehicle for communication than the carrier pigeon, so new and greater developments lie ahead.

Today, as never before, this field offers an opportunity for constructive work in design, purchasing, manufacture, finance, distribution and other phases. In short, a many-sided field of work in which the ultimate horizon still lies far beyond any present view.

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We invite you to learn more about TASC. Join us Thursday night, February 26th, in the Squire Student Center, Room 315, from 7pm — 9pm for a company presentation. We will also be on-campus the following day, Friday, February 27th, to conduct personal interviews. To arrange an interview, please contact your College Placement office today. Plan to attend both sessions. If you are interested but unable to attend, please send your resume to Jay R. Phillippe at:

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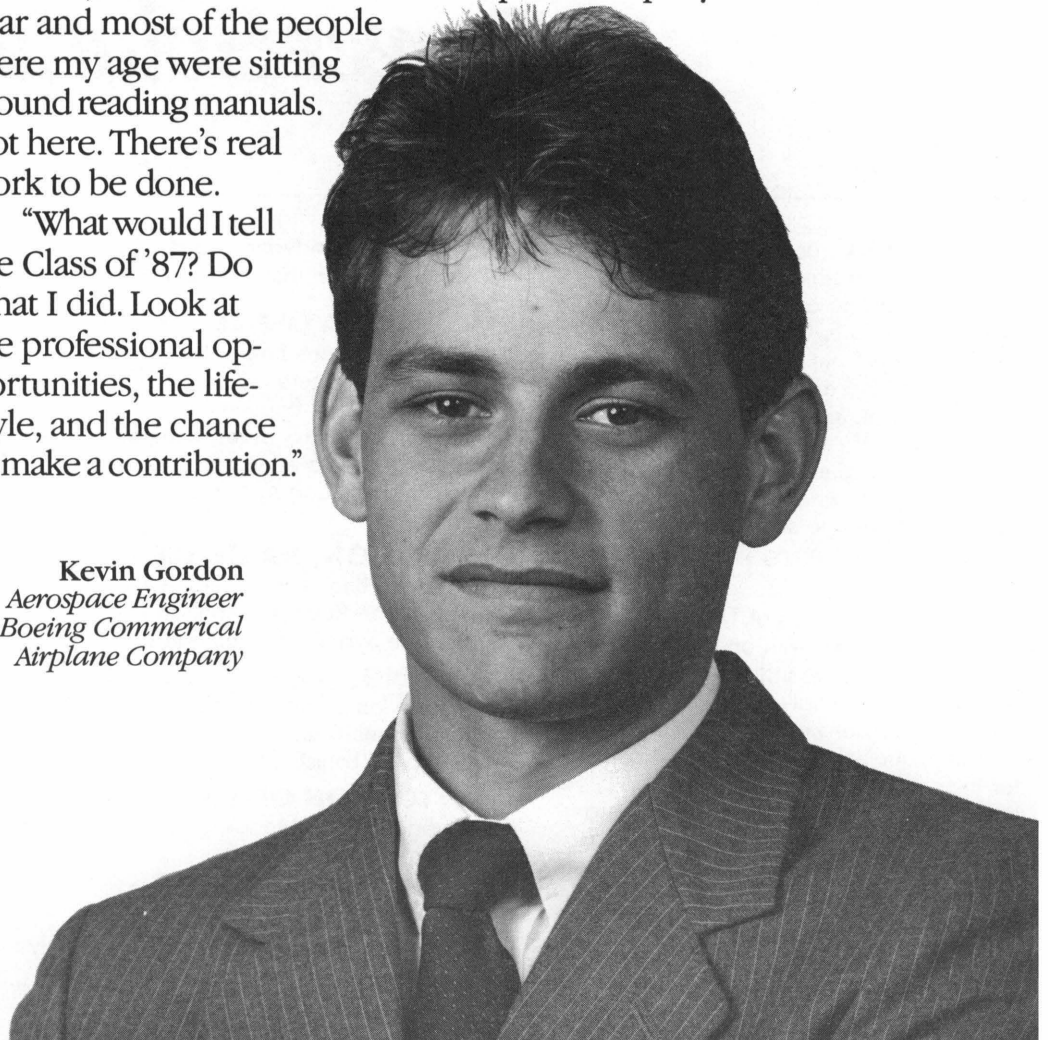
"I chose Boeing for many different reasons — some professional, others personal. From a professional standpoint, aerodynamics is what I want to do, and I wanted to work for the company that sets the standard for quality.

"I looked at salary, too. But not so much as at geography. Work is only a part of life. If you work 8 hours, you spend the other 16 someplace else. And this is a great place to live.

"The work so far? Exciting. I've been surprised that I could get into meaningful work so quickly — yesterday I was on a wind tunnel test to evaluate low speed performance of a wing-tip extension for the 757. In contrast, I interned at another aerospace company last year and most of the people there my age were sitting around reading manuals. Not here. There's real work to be done.

"What would I tell the Class of '87? Do what I did. Look at the professional opportunities, the lifestyle, and the chance to make a contribution."

**Kevin Gordon**  
*Aerospace Engineer*  
*Boeing Commercial*  
*Airplane Company*



# your future. And ours.

## From the Class of '65.

"When young people ask about career decisions, all I can honestly do is tell them my own experience.

"I looked for a company, not just a job. I considered the company's reputation for quality. And I looked at the percentage of sales set aside for research and development because that's a company's investment in its own future. And the future of its employees.

"Boeing was tops in all categories.

"If I were to give advice, in addition to relating experience, I'd say this: look for a wide range of opportunities. For flexibility.

"Boeing is a family of companies, many with operations near Seattle. The engineers who work here have found it possible to make important career changes without forcing disruptive changes in their family life. If you're

looking for professional opportunity, be certain to look at the company, not just the job."

We have high standards and we need good people, with spirit, to help us maintain our competitive edge.

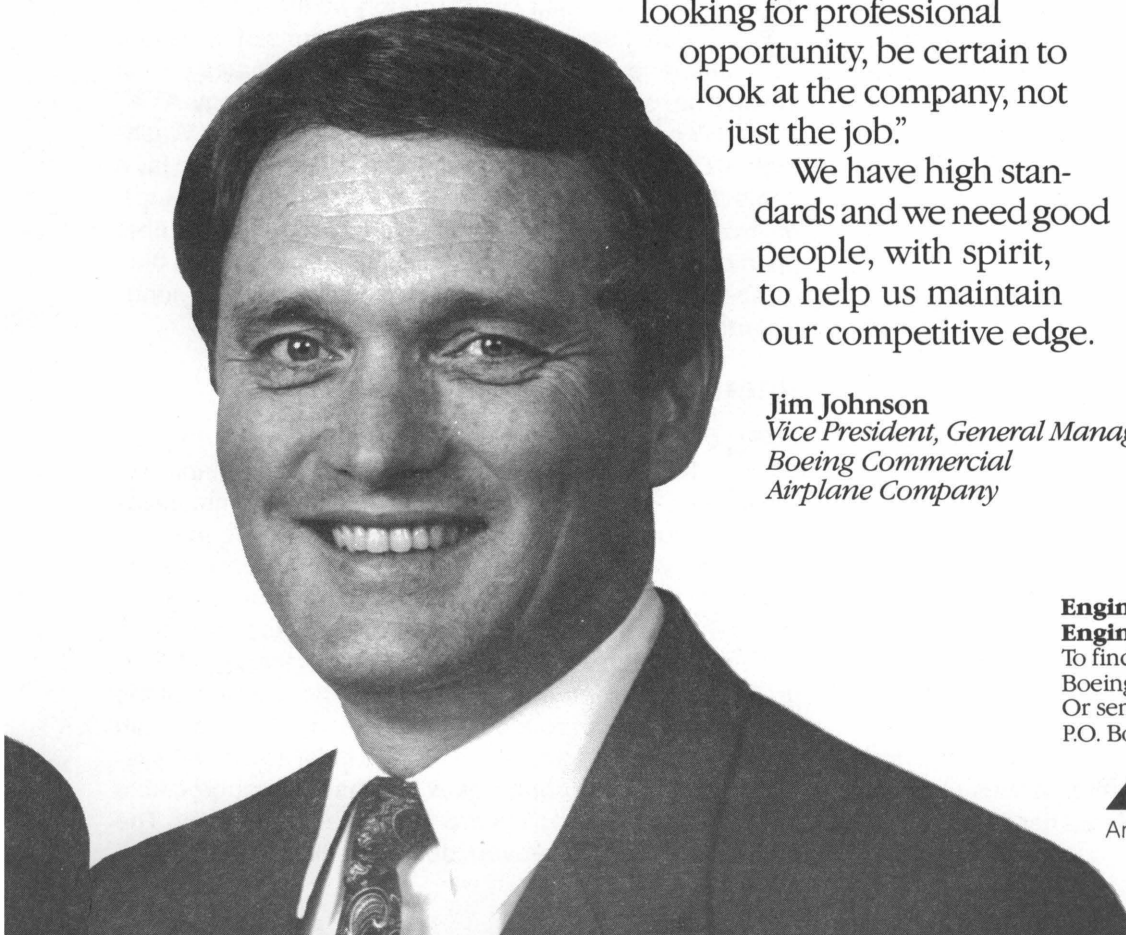
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# FIBER OPTICS

## The New Wave of Technology

by Eli Fahel and Stefan Kim

**F**iber optics, the latest major breakthrough in the communications industry, is greatly altering and enhancing our telecommunications interests. This remarkable scientific achievement will not only serve the telecommunications network, but various other applications as well. The speed, efficiency, and economy of a fiber optic system are essential for the needs of modern technology.

### An Overview of Fiber Optics

**T**he core of fiber optics is the glass fiber which is utilized as the medium for transmission. This glass fiber, the thickness of a horse hair, is combined into strands to make a cable. These glass strands are so pure and transparent that light travels inside them for many miles with negligible loss of the source signal strength.

The signal that is telegraphed through this medium is produced by a laser. The laser sends pulses or flashes of high frequency signals at the input which will be received and decoded at the output terminal after travelling a set distance through the fiber. In an overview, a fiber optic communications system involves a signal being transmitted in coded laser light through thin strands of glass fiber and decoded to produce an output signal. The data can often be transferred from source to destination in fractions of a second.

### Glass vs. Copper

**T**he copper wire industry will suffer from the incorporation of fiber optics into our communications system. Copper wire has reigned as the most convenient and inexpensive medium for most electronic systems. Fiber optics is already putting an end to this in various places. The long-range advantages of this new technology give copper a clear disadvantage when speed and low cost are of great concern.

Copper wire, still the dominant component in the communications industry, transfers information from one destination to another by means of electrical pulses coded in 0 or 1. Fiber optics uses the same coding structure. This form of digitization is the basis for telephone networks, computer links, and various other applications. The carrier of data in the case of copper wire is the electron or the electric current. Fiber optics, on the other hand, utilizes the light beam, the speed of which is unequalled. There are distinct advantages:

1. It takes a laser 1 second to transmit 480 copies of a magazine issue through a glass fiber that would require copper wire 21 hours. The enormous difference in speed is achieved by a laser blinking up to 2 billion times a second.

2. Laser light is immune to interference by electromagnetic fields which hinders communication through copper wire and cable.

3. Data transmitted by fiber optics can travel great distances without having the signal weaken appreciably. Copper phone lines need repeaters to amplify the signal at 1-mile intervals. Fiber optic cables can handle destinations of 30-40 miles before the light signal is amplified. This low attenuation characteristic of a fiber optic system makes it a very feasible method for long-range communications, particularly in the telephone industry.

4. Fiber optics is also favored over copper wire because of its handling capacity. A fiber optic cable that is less than an inch in diameter is capable of carrying up to 400,000 calls simultaneously, out performing today's densest microwave-radio route by a factor of 10.

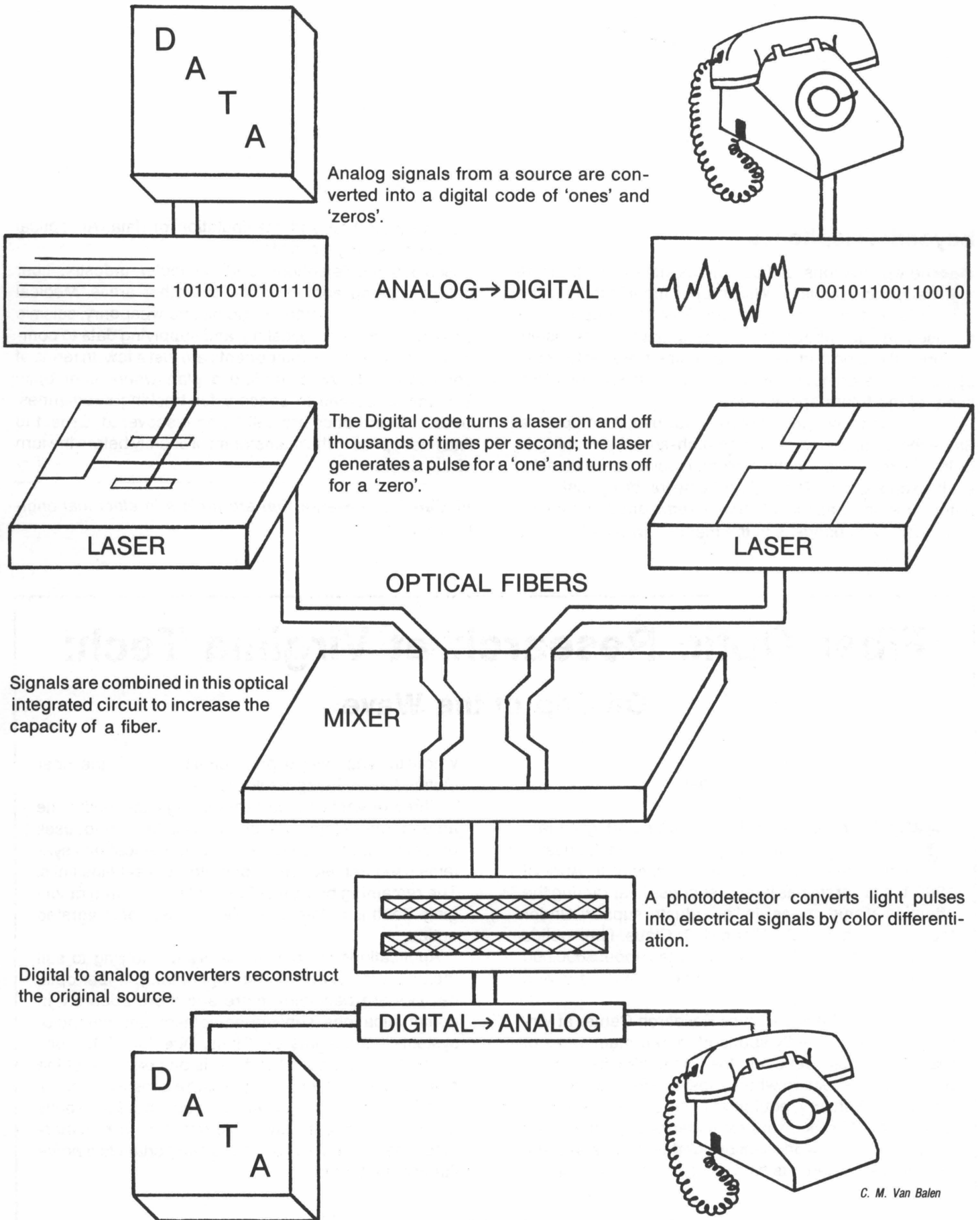
### And the Winner is...

**T**he phone industry will probably be the top benefactor from fiber optic technology in terms of costs and efficiency. Fiber optics will save an estimated 85% of the cost per circuit mile spent on present technology. AT&T recently completed a fiber optic cable link between Washington, D.C., New York City, and Boston, and plans to lay a cable across the Atlantic Ocean to England and France. MCI, an arch rival to AT&T, is laying 4,250 miles of fiber optic cable. On the whole, a dozen major companies plan to spend \$6 billion in the next 4 years to build long-distance fiber optic networks.

### International Acclaim

**C**ountries throughout the world are realizing the advantages of such a system and are beginning to take measures in redesigning their communications networks. Japan has made an aggressive move to control new fiber optics innovations by heavily investing in research and development. The Japanese developed a laser which clocked 1.6 billion pulses per second through a 19-mile stretch without reamplification of the signal. Progress has since increased the speed and distance of the signal. Bell Labs produced a laser which flashed 2 billion pulses per second over 44 miles, the most advanced system to date. Other countries which have an appreciable investment in fiber optics are France and Germany. The U.S. and Japan, however, dominate the market in all aspects.

# HOW INFORMATION TRAVELS ON A LIGHT BEAM



C. M. Van Balen

## Beyond Telephones

**T**he applications of fiber optics go far beyond the telephone industry. With proper modification to the coding and decoding of the signal, fiber optics can be used in just about any form of data transmission. Although it is a bit premature to examine the effect of fiber optics on the computer industry, we can speculate on some of the future applications.

Fiber optics have great potential for use in computers. Since the computer is reliant on high-speed switching in its logic circuits, fiber optic switching devices are ideal for such an application. The logic scheme for the optical computer is the same as that of today's semiconductor-based computer. The change is in the medium which allows for

the transportation and manipulation of data. An optical computer is very possible.

Besides the telephone and computer industry, fiber optics is being applied in various other areas. Medical imaging, artificial vision for robots and weaponry, seismic surveys, weather forecasting, and supplying data to computers from sensory components are just a few. In terms of defense, the Navy is funding a plan where fiber optic equipment is used in sensors for tracking submarines. Uses of fiber optics are still being discovered. Expect to find fiber optics in the mainstream of society before the turn of the century.

---

*Eli Fahel and Stefan Kim are juniors in electrical engineering.*

# Fiber Optic Research at Virginia Tech: On Top of the Wave

*by Eli Fahel*

**T**he fiber optics undergraduate and graduate teaching program at Virginia Tech is the largest in the country. Since its establishment in April of 1986, the program has been a success in attracting the attention of students as well as industry support. Under the directorship of Dr. Richard O. Claus, fiber optics research at Virginia Tech accumulated about \$600,000 in funds this past year from various industry and government sources.

The Fiber & Electro-Optics Research Center at Virginia Tech is currently sponsoring four main areas of research. Fiber Sensing, the most heavily funded branch, is the section where most of this effort is concentrated. Sensory equipment for commercial ship application, fiber sensors for material evaluation, and various other network sensors pertain to this section. Elsewhere, research is beginning in Fiber Fabrication

where the capability of producing the fiber in the Fiber Optics Lab is being explored.

Three projects are currently being examined in the area of Fiber Communications. This branch focuses on LAN (Large Array Network) communications systems used in telephone, computer and satellite links. The remaining branch of fiber optics research at Virginia Tech is in the relatively new field of integrated optics.

Applications in fiber optics are multiplying to suit the demands of advancing engineering. "Fiber optic devices are becoming more and more apparent in communications, sensory equipment, and computer systems," comments Dr. Claus, Director of the program. "The thermostat of a car is one example of the extent of such a technology. Being a sensory element, a fiber optic thermostat will run much more efficiently and is economically favorable over the current thermostats. The same advantages can pertain to a home lighting system."

# calculators



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by Eli Fahel

**T**he student ISHM (International Society for Hybrid Microelectronics) Chapter of Virginia Tech recently took a plant trip to Analog Devices, Inc. located in Greensboro, N.C., as part of a sequence of activities the group sponsors throughout the year. The trip was organized by the president of the chapter, Jeff White, in coordination with Dr. F. W. Stephenson.

The group of 15 members spent the day listening to informative lectures and observing various operations undertaken in the Analog Devices' facilities. Analog Devices, Inc. is involved in the manufacture and sale of an extensive line of electronic components, subsystems, and systems. The aim of the trip for ISHM was to gain exposure specifically in the fabrication and processing of hybridized electronic circuits. Representatives from Analog Devices took special care by relating this information in terms of the group's level of understanding to the subject. The group was briefed on the hybridization techniques and various precautionary methods devised by engineers to ensure maximum performance in the sensitive production process of this industry. Economical factors and feasibility of products was also related to the members.

Among the 15 on the trip, Professor Shinzo Onishi and Instructor Doug Hopkins of Virginia Tech's Electrical Engineering faculty were included. In terms of the significance of such plant trips, Doug Hopkins comments: "It broadens and clarifies the perspective of the student. By giving the student a chance to observe the applications of the subject he or she is studying in the class environment, the material will have more substance."

# GALLIUM ARSENIDE

## Lights a New Path

By Eli Fahel and Stefan Kim

**T**he semiconductor industry is making room for newer competition in a race for speed, density, and feasibility. The latest to enter this race is the compound Gallium Arsenide (GaAs). Although the major focus of the GaAs technology is still at the research and development level, a wide range of applications are on the market and enroute to becoming valuable assets to modern electronics.

Gallium Arsenide is not entirely a new product on the market. Its existence dates back to the 1960's, and since has found its most common use in the light emitting diode (LED). However, past applications are only minor indications of Gallium Arsenide's full potential. The electronics industry is just now beginning to utilize Gallium Arsenide in other areas.

"Silicon is undoubtedly the backbone of the semiconductor industry," according to Dr. Larry Burton of Virginia Tech. Dr. Burton and staff have been researching the various properties of GaAs through the support of Texas Instruments and the Virginia's Center for Innovative Technology. "The current market for GaAs is relatively small due to the dominance of Silicon in computer chips. A great disadvantage for the GaAs industry at this point is the processing expense. Gallium is a very scarce and expensive element while Arsenic is not as scarce but very volatile. Silicon, on the other hand, is the second most abundant element on Earth (Oxygen is the first). In effect, GaAs start-up requires a hefty initial cost, more than some industry heads are willing to gamble on."

There is also another factor which makes GaAs more expensive for manufactures. "Silicon forms an oxide layer ( $\text{SiO}_2$ ) during the manufacturing process which gives the material excellent passivating and dielectric properties along with chemical stability. GaAs manufacturers have yet to achieve a comparable technique for the formation of this layer. Other methods are being examined to compensate for this drawback.

"GaAs does offer us distinct advantages over other materials in vital areas of the electronics industry." A primary asset for GaAs is its superior electron mobility compared with Silicon and Germanium. For example, it has 5 times the processing speed of Silicon. This property enables transistors to have higher frequency limits, and IC's to have higher rates of switching. Also, high speed GaAs-based lasers can transmit billions of bits of data per second in various telecommunications systems.



T.J. Glaab

*Innards of the cold head. The GaAs crystals are placed in an evacuated slot for testing. Leads coming out of the cold head are routed to an instrument panel.*

Another vital property of GaAs is that light is emitted instead of heat in the active region of the device. The electrons of GaAs compounds returning from the conduction band to the valence band will send out a deep red emission, a primary property for LED's. This characteristic makes GaAs valuable in optical devices, computer display screens, lasers, and various other applications.

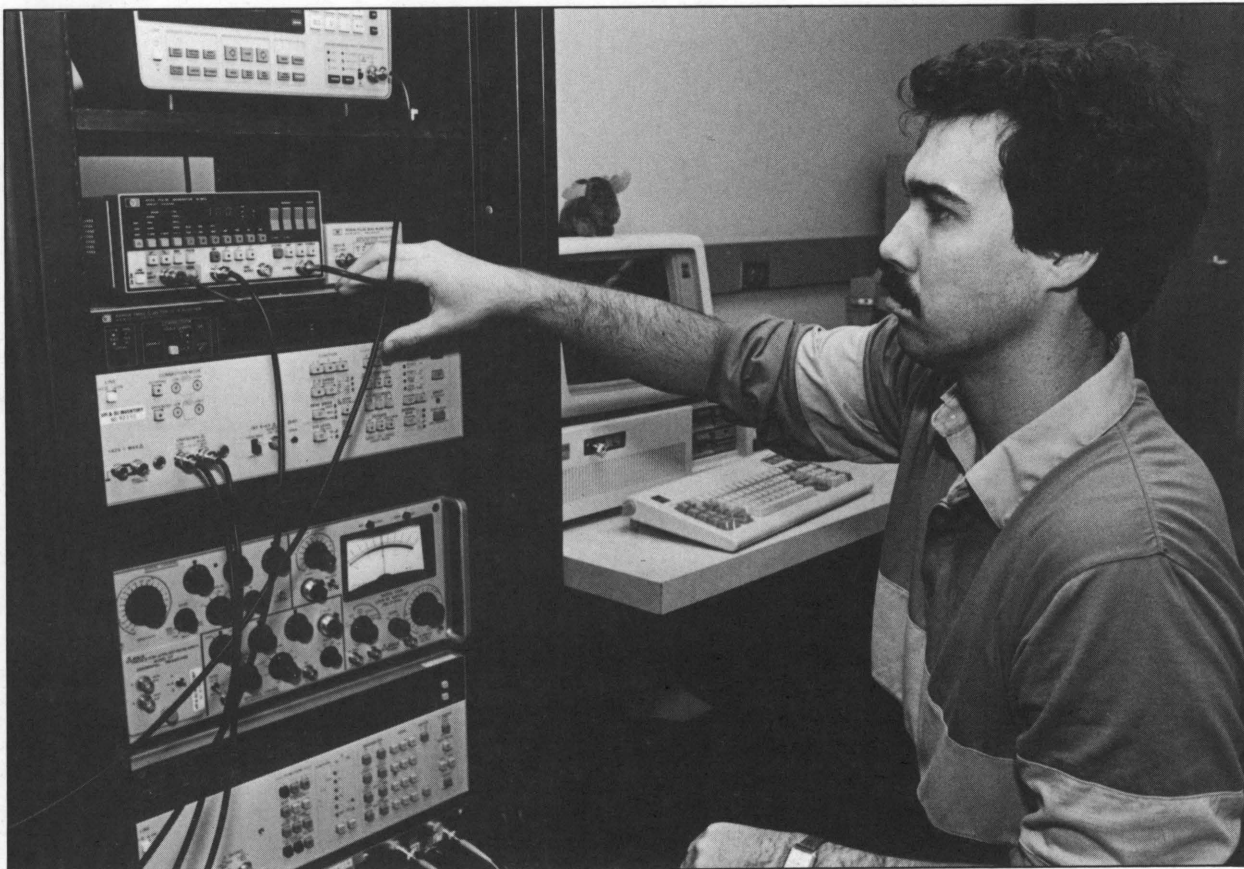
A third advantage of GaAs is a higher gap energy than Silicon and Germanium. This high gap energy, 1.4eV, enables GaAs to withstand temperatures of up to 400 degrees Celsius. GaAs is also a better insulator at lower temperatures.

GaAs chips are now being used in devices which exhibit characteristics superior to comparable Silicon or Germanium devices. It has dominated the LED industry because of its unique property and is now finding uses in integrated monolithic device technology.

Current monolithic device technology shapes materials and chemically processes them to produce integrated circuits. This ability enables Large, Very Large and Ultra Large Scale Integration (LSI, VLSI, ULSI). This technology will probably eliminate the discrete component system. More specific areas currently being probed with GaAs technology are MESFET (Metal-Semiconductor Field Effect Transistor), varactors, transistors, microwave diodes, injection lasers, bulk microwave power sources, negative resistance amps, and optoelectronics.

"With its dominance over other semiconductors in light emission, mobility, and the benefits in microwave technology, GaAs is bound to gain a broader hold on the semiconductor market," says Dr. Burton. "GaAs is showing great improvement. A concentrated effort in [developing] the GaAs industry will no doubt lead to wider applications of GaAs in modern society. Gallium Arsenide is one of the main materials for the future!"

Matthew Dawson



T.J. Glaab

*Processing steps performed by GTA Eric Cole analyze the specific properties of a GaAs sample inside the cold head.*



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# Trivia Quiz

by Aaron Lesser

1. What is the oldest building on campus?
  - a. Burruss Hall
  - b. Solitude
  - c. Major Williams
  - d. Hillcrest
2. Who performed the first successful heart transplant?
  - a. Christiaan Neethling Barnard
  - b. Marcus Welby
  - c. Alexis Carrel
  - d. Walter Reed
3. Who first demonstrated cathode-ray deflection in an electric field?
  - a. Ernest Rutherford
  - b. Joseph John Thomson
  - c. Benjamin Franklin
  - d. Jonathan Cathode
4. What year was this school founded?
  - a. 1929
  - b. 1830
  - c. 1890
  - d. 1872
5. What was the total enrollment of the school the first year?
  - a. 18
  - b. 207
  - c. 132
  - d. 7892
6. Who invented the diesel engine?
  - a. Mikolaus August Otto
  - b. Rudolf Diesel
  - c. Henry Ford
  - d. Jean Joseph Etienne Lenoir
7. The first four year degree awarded at Va Tech was:
  - a. Bachelor of Science
  - b. Bachelor of Agriculture and Life Sciences
  - c. Bachelor of Philosophy
  - d. Bachelor of Arts
8. Who invented alternating current transformers and motors?
  - a. Thomas Edison
  - b. George Westinghouse
  - c. Michael Faraday
  - d. Nikola Tesla
9. Which is Vawter Hall named after?
  - a. a famous virgin
  - b. the German word for water
  - c. a past member of the Board of Visitors
  - d. a past school president
10. Who developed Nylon?
  - a. E. I. DuPont deNemours
  - b. Wallace Hume Carothers
  - c. George S. Ester
  - d. Victor Grignard

Answers: 1b, 2a, 3b, 4c, 5d, 6b, 7d, 8d, 9c, 10b

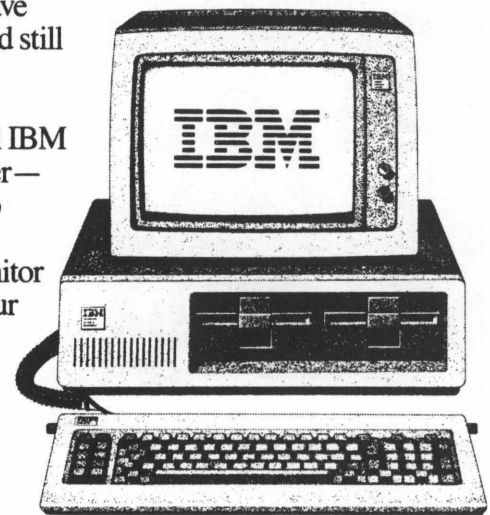
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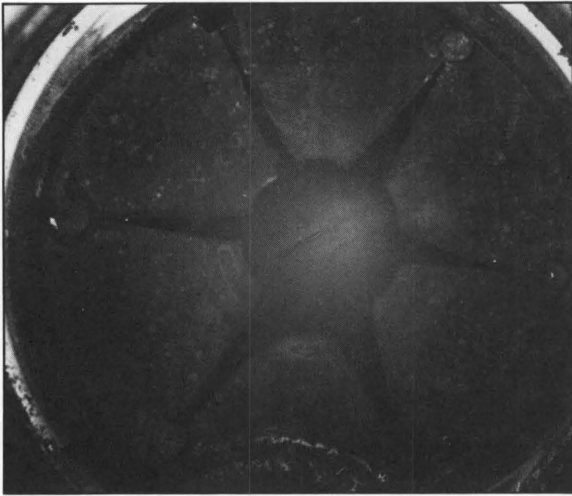
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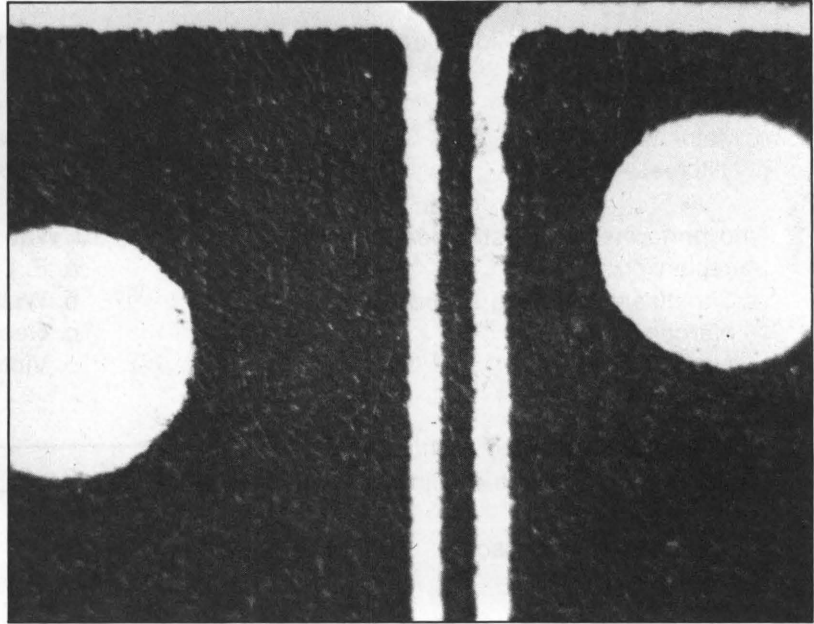
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# Picture Quiz

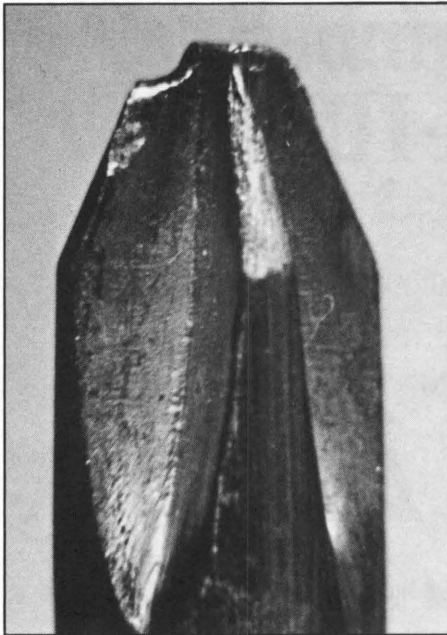
Can you identify these familiar objects?



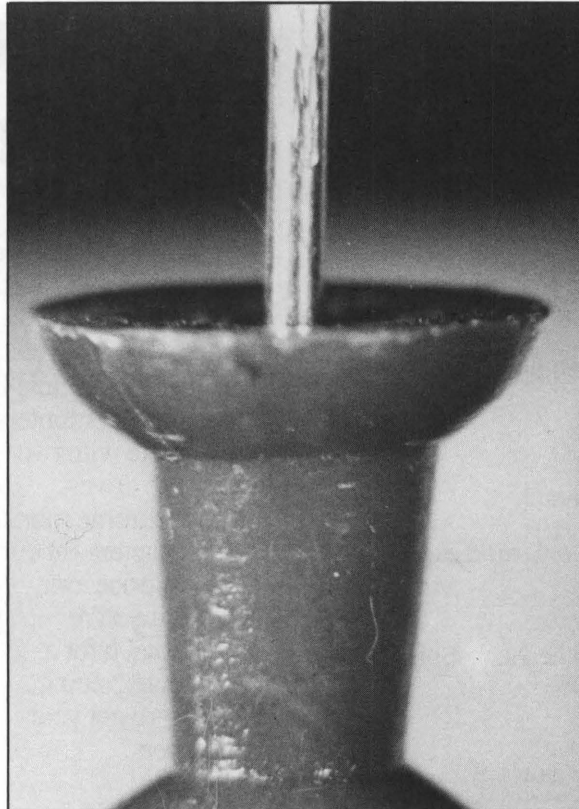
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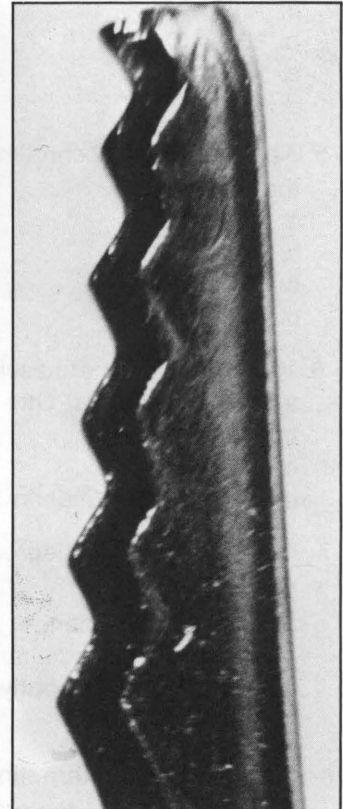
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4



5

Answers:

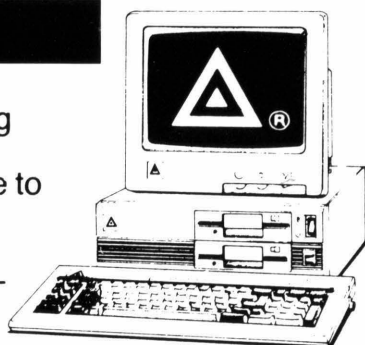
- 1) Dispose-all
- 2) Domino's logo
- 3) Phillips-head screwdriver
- 4) Push-pin
- 5) Alligator clip

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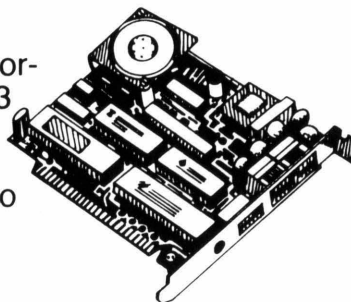
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