Further, the law professor predicted a scanning device that could go farther—and actually read the letter inside without the bother of opening the envelope. (Washington experts in the field later acknowledged this could be done, but that steaming open the envelope was quicker and surer, especially with folded letters.)

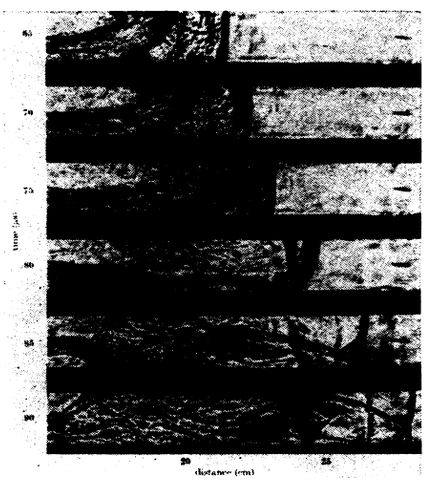
Any such data center, Miller predicted, would quickly develop branches around the country, and be more or less open to eavesdroppers along its telephone lines or microwave circuits. He recommended that any such transmissions be scrambled.

Eventually, he said, it may be proved that computers themselves give off some clue to what is going on inside them, and that their secrets could be garnered from such emissions.

Explosion Photographed

Laser photographs made with pulses of light one-billionth of a second long have shown for the first time exactly what happens when a gas explodes in an open-ended tube. The experiments may lead, among other applications, to higher power for rocket engines.

Dr. A. K. Oppenheim of the University of California, Berkeley, said the photographs taken in the experiment showed that explosions take place in four stages, the most important being



Royal Society

Explosion within an explosion.

an "explosion within the explosion" which happens in front of the advancing flame of the burning gas.

When the gas—hydrogen and oxygen in this experiment—is ignited, the flame is preceded by a number of shock waves which move along the length of the tube. If the gas is pumped into the tube fast enough, the shock waves pile up and merge, and the flame also backs up and becomes turbulent. This turbulence is the second stage of the explosion. The third stage takes place when the merged shock waves, under high pressure, become hot enough to set off a secondary explosion, ahead of the first flame. This second explosion, in the fourth stage, sends its own shock waves back into the first explosion causing tremendous pressures within the tube.

Dr. Oppenheim, reporting to the Research Applications Conference of the Air Force Office of Aerospace Research in Washington, said that most rocket engines operate in the first stage of explosion, where the shock waves reach the end of the rocket without merging. Advanced high-power rockets, such as the Saturn, operate in the second stage, where the flame has become turbulent. This is done by pumping the burning gasses into the thrust chamber faster, thus getting more burning and more power. If the gasses go into the chamber too fast, though, the third and fourth stages are reached and the rocket is likely to explode.

Dr. Oppenheim said, however, that a study of the phenomenon of secondary explosion, through pictures such as he took, should make it possible to use the higher power range of the third and fourth stages to make more powerful rockets.

Magnetic Plastics In the Offing

A new series of polymer plastics, which among other things are magnetic, act like metals and semiconductors, and withstand temperatures up to 1,000 degrees F, are within reach as a result of research by Dr. Manuel Ballester of the University of Barcelona, Spain. Dr. Ballester reported his findings to the Research Applications Conference in Washington last week.

Most plastics are large molecules made up of carbon and hydrogen atoms. These atoms combine chemically in many different shapes—rings, chains, and combinations of the two. The shape of the molecule determines its physical and chemical characteristics.

What Dr. Ballester has done is substitute a chlorine atom for each hydrogen atom in a number of complex molecules. This was difficult because chlorine atoms are about eight times bigger than hydrogen atoms, and could not be fitted together as easily. Once formed, however, the carbon-chlorine molecules showed amazing strength and resistance to other chemicals. And some forms, called free-radical chlorocarbons, can be magnetized.

The magnetic properties of the newly discovered materials depend on the way carbon combines with other atoms to form molecules. Atoms combine by sharing electrons with other atoms, and atoms differ in the number of electrons they can share. Carbon can share four electrons, hydrogen can share one. Chlorine, although it is bigger and has more electrons than hydrogen, can also share only one electron.

Although carbon usually combines with other atoms so that all four of its shareable electrons—called valences—are used up, some compounds of hydrogen and carbon have been formed in which the carbon shares only three electrons. These are called free radicals. The compounds are very unstable, however, because the free electron combines quickly with oxygen and many other materials and a new substance is formed.

Free radical compounds of carbon and chlorine can also be formed. Like the hydrogen-carbon molecules, they have carbon atoms which share only three electrons and have a fourth free. These free radicals are very stable, because the large chlorine atoms shield the free electron from outside reagents so that it can't combine with them.

The magnetic property of the new molecule is a result of that shielded free electron. Magnetism can be induced in a material by causing a number of its electrons to spin in the same direction, and the free electrons can be made to do just that.

The free electron may also be used to carry current, or to make the plastic act as a semiconductor, Dr. Ballester says. Other chlorocarbons might be used to form unusual electric fields, or to store electrons or electrical charges.

Einstein Award Winner

Dr. Marshall N. Rosenbluth, 40-year-old physics professor who will leave his post at the University of California in San Diego to join the Institute for Advanced Study next fall, has been named winner of the Albert Einstein Award for 1967.

Dr. Rosenbluth is a theoretical physicist who has made outstanding contributions to such fields as high energy nuclear physics, thermonuclear weapons and controlled fusion power.

He received his B.S. from Harvard in 1944 and his Ph.D. from the University of Chicago in 1949.

While he was an instructor in physics at Stanford University in 1950, Dr. Rosenbluth developed a formula describing how high energy electrons are scattered by protons, a theory that has been vertified at all electron energy levels used in scattering experiments.

At the Los Alamos Scientific Laboratory in the early 1950's, Dr. Rosenbluth, with Dr. Conrad Longmire, was responsible for the planning and detailed calculations that led to the first

thermonuclear explosion. This work was theoretical, involving the use of computers, as well as paper and pencil.

After 1952 when the first hydrogen bomb was tested, Dr. Rosenbluth's interest shifted to problems concerning the controlled release of thermonuclear energy. Since then, he has made many significant contributions to theoretical understanding of how thermonuclear plasmas are confined, a requirement for a successful fusion power reactor.

The Einstein Award, established in 1949 on Einstein's 70th birthday, consists of a gold medal and a prize of $5,000.

Mummies' Teeth

University of Michigan

University of Michigan

Rameses II: Royal Egyptian periodontal problem; he had worn teeth as well.

The pharaohs and queens of ancient Egypt had the same dental problems people have today—only they didn't have fillings or other repair work according to 250 X-rays brought back by a University of Michigan scientific expedition to Egypt.

It is believed that the Egyptians of this period between 1580-1000 B.C. had dentists available and that they made restorations and bridges of some type, but there is no evidence of this in the 40 rulers X-rayed.

Rameses II, reputed to be the pharaoh who reigned when Moses was born, had an extreme case of destructive gum disease, with a marked loss of bone tissue around the sockets. His teeth appear to be badly worn, possibly as a result of a coarse diet, Dr. James E. Harris, professor of dentistry, reports.

Among the other rulers whose X-rays are being studied at the University of Michigan are Merenptah, who according to popular tradition, drove the Israelites out of Egypt; Sety I, a great warrior king who reestablished Egyptian dominion over Palestine, Libya, Syria, Phoenicia and other Middle East regions; Amenhotep I, one of the founders of the XVIIIth Dynasty; and Sekenere II, who drove the Hyksos out of Egypt.

Some of their jaws show a distinct malocclusion, or bite, which could be due to the embalming process, though Dr. Harris believes this is unlikely.

Lateral X-rays of the full head were made with a portable unit using a nuclear energy power source, radioactive ytterbium 169. Most pictures were shot through the glass and oak display cabinets that protect the mummies in the Cairo National Museum, but the pictures of Amenhotep I were taken through his closed sarcophagus.

Assisting Dr. Harris in taking the X-rays was Dr. Samir Loutfy, professor of orthodontics at the University of Alexandria, Egypt. Historians, museum officials and security agencies of the United Arab Republic cooperated in the project, which was financed by the National Institutes of Health and the University of Michigan.

Dual 'Pill' Mechanism

Birth control pills, which prevent conception by suppressing ovulation, may work by a dual rather than single mechanism, preliminary studies on 50 white rats show.

Tests with Enovid, one of several similar oral contraceptives, suggest the pills act directly on the ovaries by inhibiting an important enzyme system present in the ovaries and in male sperm cells. In what is thought to be the first report of this effect, scientists from Meharry Medical College, Nashville, last week presented tentative evidence that birth control pills block the action of the hyaluronidase enzyme in female rats, making them unable to ovulate. The hyaluronidase enzyme system effects the release of ripe eggs from the ovaries and the ability of sperm cells to penetrate the eggs. Corn oil and other substances used on control animals were found to have no influence on the enzyme system.

The experimental animals, divided into five groups of 10 each, were studied during a six-week period when they received tri-weekly injections of the drug or a control substance.

The growth of cysts noted in the rats receiving high concentrations of the contraceptive drug may be related to the fact that ovulation was suppressed and that larger than normal eggs developed in the ovaries. It is not possible to determine from this the incidence of cysts developing in women because the necessary tissue studies cannot be made.

The second, previously postulated, way oral contraceptives work is by acting on the pituitary gland which produces gonadotrophins or sex hormones that stimulate ovulation.

Drs. Henry Moses and Horace Frazier, and Burton Schwartz and Allen Burnstein reported their findings to the International Academy of Pathology meeting in Washington, D.C.

O_2: A Dangerous Drug

Oxygen can be lethal if it is misused.

Because it is administered in hospitals so frequently, many physicians don't really think of it as a drug and tend to overlook the hazards inherent in its use, Dr. Philip C. Pratt says.

When oxygen is given therapeutically at increasingly high pressures over a period of even a few days, it can cause thickening of the lung's alveolar walls through which oxygen must pass on its way to the blood. When an overdose of oxygen results in this thickening, its door to the blood is closed and can, in some cases, cause death, Dr. Pratt believes. Experiments he and his associates conducted on rats show that this adverse effect of oxygen occurs primarily when the patient is subjected to continuous doses of gradually higher concentrations. Rats were exposed to atmospheres of 40 percent, 60 percent, then 80 percent oxygen for four days each and sacrificed at the end of the experiment. Lung damage resulting from the oxygen was found. Though oxygen damage to tissue was noted previously, Dr. Pratt believes this is the first experimental evidence confirming the fact oxygen itself is toxic. He and his colleagues began their investigations when they discovered they were able to identify, from lung tissue taken at autopsy, patients who had been given oxygen a few days before death.

In most cases, oxygen therapy should be discontinued when the level of oxygen saturation in the arteries has reached normal, Dr. Pratt says. It is not particularly difficult, though moderately expensive, to test routinely oxygen levels in the blood of patients receiving oxygen, he said in an interview; "All hospitals can do it."

Alveolar thickening, which appears