SCIENCE NEWS

COMMERCIALIZED ELECTRONS

Science Service

THE atoms of which all matter is composed were described as sort of half-tamed solar systems by Dr. Paul D. Foote, head of the department of atomic physics at the U. S. Bureau of Standards, in an address before the American Institute of Chemical Engineers at Washington on December 6. These "solar systems" are capable of a certain amount of control by man, and upon this control depends all progress in chemistry and not only that but all progress in all applications of science to the use of man.

The electrons which compose the "planets" of these atomic systems have literally been commercialized, and whole industries are absolutely dependent on the understanding of the caprices of these minute particles which are really electricity. An electron thrown out of a glowing vacuum tube filament makes telephonic communication across the sea possible, another electron may produce the light of the arc lamp; under other conditions they are responsible for all the reactions which are the basis of the chemical industry.

These atomic "solar systems" consisting of a definite number of infinitesimal electrons whirling about a central nucleus, while in some ways resembling our well-known family of planets, are in other ways very different from it. For example, said Dr. Foote, if a comet or stray body big enough to have any effect were to collide with a real planet, the whole energy of our solar system would be permanently altered. But if a "comet" in the shape of some form of radiant energy collides with the electron of an atom revolving about its nucleus something quite different occurs. The energy of the system is increased, but only by a certain perfectly definite amount, and if there is any energy left over the "comet" takes it along with it on its journey. Real solar systems differ in energy; no two are alike; but all the atoms of the same kind of element are systems of identical energy and structure, and each behaves exactly like all its fellows.

The "solar system" theory of the atom now being expounded in this country by Professor Nils Bohr is not so satisfactory to the chemist as a static theory which provides fixed points for hooking up atoms to make molecules. But Dr. Foote thinks that the dynamic and static theories are not really in conflict.

The outer orbits of electrons might be regarded, for instance, as the corners of a cube, and this simple static picture of an atom is sufficient to explain many known facts.

Atoms after all, he concluded, are more complicated than either a cube or a sphere, and newer facts require newer theories. These Bohr has attempted to provide by the use of data provided by the spectroscope. The Bohr theory while a distinct advance will, in Dr. Foote's opinion, either be eventually superseded by a better one, or will be so modified that it will lose its identity. Its present success is due to the vast number of observed facts which it has been able to correlate by means of a very few and simply stated ideas.

HELIUM GAS AND AIRSHIPS

Science Service

THERE is enough helium gas now available in the United States to keep filled and ready for service 200 airships of the size of the navy dirigible *Shenandoah*, according to Dr. Richard B. Moore, former chief chemist of the U. S. Bureau of Mines. These ships can be kept in the air for five years.

According to Dr. S. C. Lind, successor to Dr. Moore as chief chemist of the Bureau of Mines, laws for the conservation of the helium resources of the country will be introduced at this session of Congress. The gas occurs principally as a constituent in the natural gas wells of Texas, and the problem is to separate it from the inflammable part of the natural gas which may then be used for industrial purposes. There is a great demand for the unseparated natural gas, from which the helium is absolutely lost unless special measures for recovery are taken.

Helium inflated airships are useless for very long flights unless some method for condensing the water vapor, which is one of the products of combustion of gasoline, is employed. Such a method has been devised. It prevents the ship from getting lighter and lighter, and so having to release helium if it is desired to come to the surface. Rather than lose the valuable gas, the *Shenandoah* on her recent trip to St. Louis dived near to the ground and was then pulled to earth by a force of some 300 men, a method which is not always applicable. Dr. Lind said that if 90 per cent. of the water vapor could be recovered there would be no loss of weight of the ship.

The purification of helium is also one of the great problems in the industry. The best method is that used in repurification of the gas at the Lakehurst station, where it is passed over activated charcoal at the temperature of liquid air, resulting in the adsorption by the charcoal of all gases except helium and hydrogen. This results in nearly 100 per cent. helium. Airships are now using a mixture of 90 per cent. helium and 10 per cent. nitrogen.

Other important sources of helium gas besides the gas wells of the Dallas-Fort Worth district are known to the government, but their location and extent are being kept military secrets. When the industry is more developed and the needs of the army and navy are fully met, the surplus supply of the gas will be released for commercial purposes. At present the military uses absorb the entire output.

Dr. Moore, during further discussion, emphasized the unique military value of helium, saying that this country contains all the known world supply and that as an asset in time of war such a resource is invaluable and should be carefully conserved.

THE SPACING OF OIL WELLS

UNUSUALLY close spacing of oil wells, or what is known as "town lot drilling," has been responsible for great wastes of oil and for large monetary losses to investors in the development of many petroleum fields in the United States is reported by the Department of the Interior, following a study of the subject by engineers of the Bureau of Mines.

Town-lot drilling has recently become a factor in the development of the new fields of southern California. Wells are being drilled in the Santa Fé Springs field on adjacent town lots, some of which are not more than 120 feet square. Because of the great depth and the high cost of these wells the cost of developing this field will be excessive, and many wells doubtless will not pay for themselves.

The Burkburnett town-site pool in Texas furnishes a typical example of losses and wastes from close drilling. Within six months after the first well was drilled, the average initial daily production per well had dropped from 2,000 barrels to 300 barrels; within a year the average initial production was only 38 barrels a day per well. In the town-site proper, the average spacing was less than one acre per well.

The spacing of wells is an economic problem which is governed by many factors. These include the profits that may be derived, the recoverable amount of oil or gas, the porosity, saturation and thickness of the producing sands, the extent and structure of the productive area, the gravity of the oil, gas pressure and depth. Theoretically, the closer the spacing the greater the ultimate recovery of oil from oil sand. However, the many factors opposed to close spacing far outweigh the possible benefits of greater recovery of oil wells and implies the influence of promotion schemes. Town-lot drilling usually is not practiced by bona fide operators except when necessary for the protection of their property. Unscrupulous promoters often sell parcels of land far too small to warrant the drilling of a well from an economic standpoint, causing adjacent operators to drill an unnecessarily large number of wells to protect their holdings against drainage. Speed in getting a well into the pay sand is a prime requisite because the first well in any locality benefits by obtaining the flush production. It often happens that a well will produce more oil during the first 10 days or two weeks than can afterwards be pumped in a year or more. Extreme speed in drilling is largely responsible for the waste that always accompanies town-lot drilling. In order to be the first to drill into the pay sand, careless and inexperienced operators often neglect to shut off water properly and to protect sands; hence wastes from infiltration of water, dissipation of gas, and the migration of oil and gas are often tremendous. Another waste occurs because of the unprofitable yield of many wells and the carelessness with which they are abandoned.

Although oil can be recovered more rapidly and in larger amounts with a greater number of wells if they are drilled before the gas pressure is reduced, too rapid exhaustion of oil and gas may cause the rapid approach of edge water. During its encroachment the edge water may "pocket" large quantities of oil. When wells are spaced too closely, the gas pressure, which causes oil to flow to a well, declines rapidly and the wells soon cease to flow.

CARLSBAD CAVERN IN NEW MEXICO

Science Service

A RIVER that appeared not to be worth a dam was the cause of the geological explorations that resulted in the exploration of the Carlsbad cavern in New Mexico and in the discovery of its surpassing beauty and extent. The river is the Pecos. Dams built along it for the impounding of water for irrigation purposes had proved to be of little use because the water disappears underground, and so the U. S. Geological Survey, before advising the construction of any more dams, sent Dr. Willis T. Lee to the scene at the request of the commissioner of reclamation to find the cause of the river's strange behavior.

The result was the real discovery of the Carlsbad cavern, for, although it is nearly 20 miles from the river and without effect upon its course, it became known through Dr. Lee's study of the geology of the whole region and his tracing of strata found in the near vicinity of the troublesome river.

The caverns are in limestone strata 1,300 feet thick, but above and below this layer are other layers of rock salt and gypsum. These were found to be the real trouble makers. The strata are tipped at an angle to the surface, near the river and under it. The gypsum and salt are soluble in water, and when the dams were built and the water-level rose beyond a certain point, it dissolved its way through these strata underground and out on to the surface again some miles below the dam.

Tracing the strata back to the foothills of the Guadeloupe Mountains, about 22 miles southwest of Carlsbad, Dr. Lee rediscovered for the world the great cavern, now made by Presidential proclamation of October 25 a National Monument.

The caverns were first discovered in 1901. Vast numbers of bats were observed issuing from a hole in the side of a hill and exploration revealed a cavern of unknown extent. It remained practically unexplored and unnoticed until this year when Robert A. Holley, of the General Land Office, surveyed about three and a half miles of it. Dr. Lee later examined it from the geologic and scenic points of view.

It is, according to Dr. Lee, one of the greatest if not the greatest cavern in the world. Its total length is quite unknown. It extends at least 1,000 feet downwards from the entrance. The formations of stalactites and stalagmites are of extraordinary beauty. One of the "rooms" in the cavern is half a mile long, several hundred feet wide and with a ceiling so high that torches failed to disclose it, their bright beams being lost in the impenetrable gloom.

More remarkable discoveries are likely to be the result of further exploration since the geologic formations are most unusual. Underneath the limestone layer in which the cave was discovered are beds of gypsum and rock salt of great thickness. These materials are soluble in

water which seeps through and honeycombs them. Dr. Lee believes that in these beds may be sculptured other great caves whose extent and beauty can only be guessed at for the present.

Incidentally, such caverns in salt beds might be developed into mines of incalculable extent and richness. The discovery is considered the most important in the geological field in recent years.

PASTURE LANDS

Science Service

OUTLINES of a plan for the study and improvement of the pasture lands of the United States have been prepared by the advisory committee of the American Society of Agronomy for the National Research Council. The purpose of the proposed investigations is in general to find practicable means for the conservation and improvement of the pastures which feed more than half of the cattle and other farm animals in the country.

The committee states that two thirds of the cultivated area in crops in the United States is devoted to the production of feed for live stock, the proportion varying in different sections from 91 per cent. in New England to 51 per cent. in the west south central states. From other studies it appears, the committee says, that since all the forage consumed in one year would feed about 50,000,000 adult cattle or their equivalent, and since there are more than twice that number in the country, it follows that over one half of their feed was furnished by pasturage. It is estimated that pasturage costs only about one fourth as much as harvested forage.

According to the committee, "the neglect of tame pastures and the abuse of natural wild pastures is a disgrace to American agriculture. Only the fact that grass will stand an almost incredible amount of abuse has prevented its utter destruction. Relegated to land too rough to till, neglected by the farmer, abused by the grazer, ignored by the investigator, the permanent pastures still furnish at least one third of the feed consumed by domestic animals. 'Better pastures' should become the slogan of American agricultural progress."

The outlined investigation provides for the preparation of maps of the grasslands, both natural and artificial; studies of pasture plants, soils and the effects of grazing; production of meat, wool, etc., to the unit area; period and rate of grazing; fertilizers; troublesome and poisonous plants; animal and insect pests; and economic and social problems. The proposed investigations would be carried out on farms of from 150 to 300 acres, located in the principal grazing areas of the country.

In view of the enormous importance of pastures, there is need for liberal appropriations to conduct the necessary investigations. Pasture investigations have heretofore been much neglected due to lack of funds to do the work.

ITEMS

Science Service

OIL fuel vaporization in Diesel engines is neither necessary nor desirable according to a report by the Diesel Motor section of the German Engineers' Society, which states that the previously accepted belief that gasification first had to take place must be given up. The same report states that piston pressure can not be increased merely by increasing the fuel, but if air is condensed and then added the efficiency may be increased 30 to 40 per cent. Further efficiency is predicted as the result of the use of exhaust gases for compression of the intake air as is done in airplane engines. Mist explosions of liquid fuel in droplet form require more oxygen than if the fuel is vaporized.

A WIRELESS station using mountain peaks for antennae masts has recently been put into service in upper Bavaria. The wires are supported by a strong cable and extend from one peak 5,100 feet high a distance of about a mile and a half across country to the top of a smaller hill of some 2,820 feet elevation. The station is designed to communicate directly with the Far East. Special arrangements were necessary for the fixing of the cable ends and to allow for its stretching. The end of the cable is fastened to a small carriage weighted with stones and running on rails. When the cable is bent by snow or wind the carriage is pulled forward. When the stress ceases, it rolls backward on its sloping railroad.

TWO German scientific men, Professor Kleine and Dr. Fischer, have been sent to Africa by the government of the Belgian Congo to study the curvative effect of the new drug, "Bayer 205," upon animals suffering from African sleeping sickness. The effect of it upon animals is not known, but many cures have been reported among the 170 human patients treated in Rhodesia and the Congo. Although it is difficult to keep the native patients under continuous supervision, only a few died and in most cases the blood was found to have been freed from the deadly parasites. The disease, which is entirely different from the so-called "sleeping sickness," prevalent in Europe and America, is due to the bite of an insect, the tsetse-fly.

VAGRANT and injurious X-rays may be confined to the room in which they originate by the use of barium in plaster or paint, Maximilian Toch, a chemist of New York City, reported at the recent meeting of the American Institute of Chemical Engineers. Long exposure to X-rays which have escaped from doctors' offices through walls, floors or ceiling have been reported to have caused serious injury to persons in adjoining rooms, Mr. Toch said. To prevent this, lead which is impervious to the rays has been used in metallic form as a sheathing of X-ray rooms; but the metal is heavy and buildings with rooms so equipped require strengthening. This is not necessary if some compound of barium be used instead of lead, Mr. Toch said, since barium compounds are opaque to X-rays. His method has been either to mix the barium with the wall plaster or to use barium compounds in the wall paint. Either method keeps the rays where they belong.

THE United States uses nearly half the lumber in the world, more than half the paper made from wood, and about two fifths of the wood in all forms.