SCIENCE NEWS

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THE NEW CYCLOTRON AT CORNELL UNIVERSITY

AN atom smasher of new type, producing high-speed particles at relatively low voltages with safety to the operator, promises a further understanding of the structure of the nuclei of the atoms and the forces holding them together. This new tool of science has been perfected at Cornell University after more than three years' work.

It is an eight-foot glass tube, six inches in diameter, with a radio short-wave generator providing an alternating potential which changes ten million times each second. Operating very much like the distributing system of an automobile where the spark plugs ignite each cylinder in rotation, the short-wave generator alternately charges the segments of the tube through which the particles have to pass on their way to the target. In contrast to the well-known cyclotron which speeds up its atomic bullets in a merry-go-round motion, it accelerates the projectiles in a line and is called a linear resonant accelerator by its designer, Dr. Lloyd P. Smith, professor of physics at Cornell. With Dr. Paul L. Hartman, of Reno, Nevada, Professor Smith has completed his machine at a cost of about $7,000 and it is now in successful operation.

Advantages claimed for the new tool are: (1) Greater accessibility of the ion source and the target and the absence of danger from electrical shock; (2) ability to accelerate heavy atoms more successfully than the cyclotron; (3) the resonant property of the system serves to select out the atom desired as a bullet—thereby saving the target from unnecessary bombardment; (4) a vacuum for the tube is produced by a simpler process and can provide a greater beam density of accelerated particles than the cyclotron. An original voltage of 50,000 to 70,000 volts is stepped up to about a half million volts and the tube produces ions of higher intensity otherwise available only by use of voltages running into the millions.

THE THRESHOLD TREATMENT OF WATER

SOFT water that will neither produce objectionable scale or corrode plumbing can be produced cheaply from water of the hardest variety by dissolving in it a tiny amount of a simple chemical, sodium hexametaphosphate, two water supply engineers have reported.

The new treatment, which requires only two parts of the chemical per million parts of water, was first tested at Delaware, Ohio, and has been put into use in the water supply system of Columbus by Charles P. Hoover, superintendent of the water purification plant in Columbus, and Owen Rice, of the Hall Laboratories in Pittsburgh.

Known as the "threshold treatment," it solves difficult but extremely important problems which the average citizen may never be in a position to realize and which have plagued water supply engineers for years.

Hard water, unless previously softened by either acid treatment or by lime softening, makes it impossible for a user to get a good soap lather when washing. In industrial plants, it deposits hard scale in boilers and pipes, making them less efficient and leading eventually to breakdowns.

But the lime softening process is difficult to control, and the acid treatment processes have an undesirable feature—the corrosion of piping.

The sodium hexametaphosphate may be added before filtration, but the best procedure is the addition of this chemical after filtration. It is entirely non-toxic in its effects on human beings. Applied first to the specific water supply problems of some factories, the new method was thoroughly tested for toxicity before the Ohio State Board of Health would permit its trial in a city water system.

The stabilization effects are found even at temperatures approaching the boiling point of water, making it extremely useful in treating boiler waters. Trouble with scale in hot water heaters is often encountered even following partial softening or the addition of lime or soda ash for corrosion control, in the absence of the sodium hexametaphosphate.

In the acid treatment lime or soda ash are frequently added to eliminate the danger of corrosion. In those cases a slight protective scale is wanted. But the difficulty is found in adding exactly enough lime or soda ash to deposit just enough scale and no more.

EPIDEMICS OF TREE DISEASES

THE U. S. Department of Agriculture reports that London plane trees, among the few species that can stand the smoky air and other unfavorable conditions of city life, are now menaced by a killing epidemic disease. Seven thousand of the trees are dead in the Philadelphia region, and 700 in Baltimore. The disease has also appeared in Washington. The infestation is a slow killer. In the first year, cankers appear in the bark of the trunk and large limbs and dark streaks in the young wood. In the second year the leaves thin out. The tree may die then, or linger one or more years longer.

The London plane is a cross between the American and European plane trees or sycamores. It is widely used as a shade tree along streets and in downtown parks because of its hardiness under city conditions. Its disappearance would denude many American city streets and leave city foresters and park commissioners at a loss to find an equally good substitute.

R. Kent Beattie, plant pathologist of the Department of Agriculture, is seeking information regarding the distribution of diseased trees. It is requested that chips of young wood from planes or sycamores suspected of having the disease be sent to the Division of Forest Pathology, U. S. Department of Agriculture.

SUDDEN invasion by an enemy which is killing its victims so rapidly that there may be no chance to fight back is also announced by the department.

The victims are persimmon trees, valuable members of

the Southeastern hard-wood forests. Their wood is used in golf club heads, their fruit is winter food for game animals and birds, and their tough, ropelike roots help to hold hillside soil against erosion. Their loss will therefore be keenly felt.

The enemy, a fungus, was first discovered two summers ago, killing persimmon trees near Nashville, Tennessee. Last summer it was found to be wide-spread in the South, from South Carolina across the Gulf States region to Mississippi. "Explosive" is the term used by the government scientists in describing its spread.

The fungus not only kills the trees with the speed of a ravaging plague, but it rots and ruins the wood in record time. Trees killed last summer are already decayed into uselessness. No way of fighting the disease has yet been discovered. Attention is being turned on a search for possible resistant native specimens, which can be quickly propagated by root cuttings. In case these are not found, the next best thing is to go to eastern Asia for the persimmon species that grow there, for these are apparently immune to the fungus.

THE NEW ROBOT PILOT

AVIATION has a new robot pilot which automatically warns the men in the cockpit if something goes wrong. It is arousing wide interest among airmen as a possible safety advance of first rank importance.

Developed by engineers of the Curtiss-Wright Corporation's St. Louis Airplane Division under C. W. France and George Page, Jr., the new robot can flash on 90 lights to announce as many kinds of "trouble" before it happens. It "watches" the plane's instruments continually. If landing flaps are not operating properly when the plane comes in for a landing, for example, a light labeled "wing flaps" flashes on and calls the human pilot's attention to the situation. If the airport battery car is still plugged in when the pilot gets ready to start, the indicator lights another lamp. Failure to notice a dial that shows something out of kilter will be prevented by such a device. It may help prevent accidents in the future by simplifying the task of pilots in the midst of an increasingly complex welter of instruments.

The "tell-tale" indicator is the second robot pilot to find its way into the cockpit. The first, the gyro-pilot, is to-day at the controls nine tenths of the time commercial airliners are aloft.

Ten pre-selector switches enable the pilot to set the system for each of the main operations concerned in flying an airliner. Pressing one of the switches picks out the particular combination of instrument readings and control adjustments proper to the chosen operation. Deviation from the proper combination causes the revealing light to flash on. Switches are provided for test, start, taxi, take-off, left engine, right engine, cruise, landing, stop and off.

The indicator panel is similar to the indicating signal system used by the railroads and electric power industry to warn of danger or improper operation. Indicator lights for many instruments are used now, but this is the first time it has been widely applied.

With the use of the "tell-tale" system, constant scrutinizing of many instruments by the pilots is eliminated. Simplification of the instrument board of the first plane on which it is installed, the *Curtiss-Wright 20*, a 30-passenger twin-engined plane nearing completion in St. Louis, is another result achieved.

Pilot fatigue is decreased, its makers claim, and shouting of orders between pilot and co-pilot is eliminated.

LACK OF RAW MATERIALS IN SUDETENLAND

LACK of raw materials, made worse by the conquest of predominantly urban and industrial Austria and Sudetenland, is forcing an economic crisis in Nazi Germany. Germany is to-day farther away from self-sufficiency than at any time in the last two or three years, despite frantic efforts to free herself from dependence on foreign imports, particularly those for which she must pay cash.

Separated by a new economic barrier from its natural agricultural hinterland and from former world markets, the Sudetenland has placed a heavy burden on the precariously-balanced German economy. Food for 3,500,000 mouths and raw materials for her factories must now be imported. The boycott of German goods, induced partly by governmental opposition in several countries to Nazi barter trade practices and partly by popular anger at the Nazi régime, has reduced sharply foreign demand for the consumer goods made in the area. Besides, these factories compete with already existing German plants. More cash has had to go out; less has come in.

This development entirely confirms predictions made at the time the Czechs gave in to the threat of war. Seemingly accurate reports from Berlin indicate the trade deficit for old Germany amounted in 1938 to about 190,000,000 marks, while that for Greater Germany ran up to about 430,000,000 marks. A large part of this 240,000,000 mark deficit for the new areas can be laid to the needs of the Sudeten region. This deficit is even more serious than it seems, for they have been running it up for only a part of the year. Austria was annexed in March, the Sudeten districts in September.

Besides heavy chemical industries, Sudeten factories manufacture consumer goods such as toys, novelties, imitation jewelry, glassware, porcelain and textiles. The textile establishment is extensive, much of it having served a large export market. Insufficient quantities of the raw materials going into these products are found in Germany. Machine and raw material imports from the United States have increased.

Annexation of Austria has posed a similar problem, which the Nazis haven't been able to solve either. The bulk of the tiny nation's population was concentrated in Vienna, its industries were almost without exception those that would compete with existing German plants. Besides, tourists, one of former Austria's important sources of foreign exchange, have just stopped going to Vienna since the Germans changed its character from that of the delightful, "gemuetlich" city of old.

ITEMS

GENERAL use of sulfapyridine, the sensational new drug proclaimed particularly effective for treating pneu-

monia, is not warranted at the present time, in the opinion of the council on pharmacy and chemistry of the American Medical Association. The association regards the drug, which is related to sulfanilamide, as definitely experimental in status and asks that it be used only by properly qualified persons for investigations of its value in pneumococci, severe staphylococci and Friedlander's bacillary infections.

FRUITS (including such vegetables as tomatoes and eggplants) develop because of the auxin concentration in their flesh. Auxin is the chemical compound that stimulates growth in plants. Discovery of auxin's importance in fruit growth resulted from researches by Professor G. Gustafson, of the University of Michigan. He found that auxin is highly concentrated in the beginning stages of seedless fruits, and also near the seeds in other fruits.

DANGER of disease carried in milk exists in 726 municipalities in the United States. These cities and towns, the U. S. Public Health Service finds, "are still subjecting their citizens to milk-borne diseases by failure properly to require all milk distributors to show safe milk ratings." These 726 municipalities are among the 874 in the nation that have adopted the uniform milk ordinance recommended by the Service. Of the entire number, however, only 148 are enforcing the ordinance adequately. From the standpoint of milk-borne disease, it is reported that the safest communities are those in which all milk is pasteurized and in which the pasteurized-milk rating is 90 per cent. or more. Diseases that can be carried by milk are tuberculosis, typhoid fever, scarlet fever, diphtheria, septic sore throat and undulant or Malta fever.

THE most powerful permanent magnet in the world—for its size—has been developed in the research laboratories of the General Electric Company at Schenectady, New York. Only half the size of the eraser on a lead pencil, it will lift a flatiron weighing five pounds. Its magnetic attraction is several times as strong as that in any previous magnet. The strongly magnetic alloy forming the magnet can be used too in electrical equipment to replace electromagnets that require current.

UNIVERSITIES of the nation having the largest research expenditures are California, Chicago, Columbia, Harvard, Illinois and Michigan, according to a survey contained in the report of the National Resources Committee. These six schools spend over $2,000,000 a year on research each. In the group spending between $1,500,000 and $2,000,000 a year for research are Cornell, Minnesota, Wisconsin and Yale. In the $1,000,000 to $1,500,000 brackets are four schools: Massachusetts Institute of Technology, New York University, the Ohio State University and the University of Pennsylvania. Spending between $500,000 and $1,000,000 yearly for research are: Duke, the University of Iowa, the Iowa State College, the Johns Hopkins, Missouri, Nebraska, Northwestern, Penn State, Princeton, Purdue, Rochester, Rutgers, Stanford and Texas A. and M. The list, states the report, is not complete and the estimates are probably too low rather than too high.

MINORCA, link in the French lifeline between Marseilles and North Africa, is the second largest island of the Balearic group. While these islands have been fought over and handed from one power to another from Roman days and are now reported to be surrendered to Spanish rebels, their fate has been bound with that of Spain since 1349. The Balearic Islands were long a stronghold of pirates, and were conquered by Romans on this charge in the second century B.C. In the middle ages, the islands were a separate corsair kingdom, preying on coast city trade. Minorca's harbor, Port Mahon, is one of the best in the Mediterranean. The island has about 50,000 people, mainly farmers and cattle growers. Its area is 260 square miles.

AERIAL photographs vital to America's future now have a new home, half buried in a Virginia hillside just across the Potomac River from the nation's capital. Those attending the meeting in Washington on January 13 of the American Society of Photogrammetry made a special inspection trip to the new storage vaults which can hold 16,000 cans of aerial film that would weigh four tons. The vault, only recently completed, was built for the Soil Conservation Service to house its photographs. From these strips of film—nine inches across and 100 feet long—will be obtained information on which important decisions on erosion studies, land use planning and flood control will be based. Unpretentious in appearance, the storage vault contains 10 rooms of 1,000 cubic feet capacity each, which will house the film. Each room is a distinct unit and is separated from other rooms by concrete walls and double doors. At present the hillside vault is unheated. It lies mostly below ground level and an even, cool temperature is attained. Eventually it is planned to have the whole structure air-conditioned to attain the optimum conditions of temperature and humidity for film storage.

STUDIES of the Great Nebula centering around the brilliant constellation of Orion in the south these winter evenings are leading astronomers to suspect that they may be watching and photographing through their telescopes a gigantic astronomical "building block" out of which our galaxy of stars is composed. This hypothesis, presented at the meeting of the American Astronomical Society by Dr. V. M. Slipher, of Lowell Observatory, Flagstaff, Ariz., suggests that the cluster of hot stars which make up Orion and their surrounding nebulae may have had a common origin in some gigantic stellar explosion. Nova and super nova stars are examples of stellar explosion wherein a rather ordinary star will suddenly explode and flare up into a great brilliant one and then, after a few years, reduce its luminosity to low values and pass into stellar obscurity. The explosion which could have created the constellation of Orion and its accompanying nebula was something far more stupendous than such an explosion.