SCIENCE NEWS

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ATOMIC FISSION

ATOMIC fission similar to that of uranium 235, on which hopes of atomic power on this earth are based, takes place in the sun's corona, that system of luminous streamers that surrounds the sun and is visible only at a total solar eclipse. This is the theory proposed by the eminent Indian scientist M. N. Saha, University College of Science, Calcutta, in a letter to *Nature*.

The cracked atoms, stripped of many of their outer electrons, originate, according to the theory, in the layers below the corona and are hurled outward with terrific velocities. As they travel they knock out electrons right and left from the atoms they encounter, themselves alternately gaining and losing electrons as often as a thousand times in one centimeter (about 0.4 of an inch) of travel. Loss of energy through the frequent collisions finally brings the streaking fragments to a halt.

This theory accounts for a number of things hitherto obscure. The outer corona is generally believed to consist entirely of free electrons. But the origin of these electrons was never until now adequately accounted for. Mysterious "forbidden" lines have been observed in the spectrum of the corona. Many of these lines were found to be due to atoms of iron, nickel and calcium that had been stripped of many of their outer electrons. This discovery of Grotrian and Edlen, which Dr. Saha confirmed, was thought to complicate the theory of the solar corona. But it fits right into Dr. Saha's theory.

His idea is that these atoms are the result of a cracking process like the fissions of uranium, thorium and proactinium, which have been carried out on the earth. The idea is supported by recent experiments at Professor Bohr's laboratory at Copenhagen by Boeggild, Lauritsen and others. The experimenters found that fission fragments are hurled apart with velocities of about 9,000 miles per second, 1/20 that of light, which are greater than the velocities of the outer electrons in their orbits. Consequently these electrons are left behind and the fission fragments become highly stripped atoms. It is as though the sun should be suddenly whisked away, leaving its planets behind.

The forbidden lines observed in the sun's corona, forbidden because they do not occur under ordinary earthly conditions, are broad. This broadness indicates a velocity of about 60 kilometers (36 miles) per second. This is the velocity, Dr. Saha says, which they have slowed down to by the time they get far enough out into the corona for their lines to be observed.

METALLURGICAL STUDIES WITH THE ELECTRON MICROSCOPE

ELECTRON microscope pictures transmitted by television may be one of the future uses of a new scanning microscope now, however, devoted to metallurgical studies for the war industries.

The new instrument was described by Dr. V. K. Zworykin, associate director of the RCA Laboratories, in a paper read at the Institute of Radio Engineers meeting at Cleveland. Dr. James Hillier and Richard L. Snyder, also of the RCA Laboratories, collaborated in the development of the instrument. The scanning electron microscope, developed over a period of years, combines the electron microscope, television and radio facsimile. It permits study of the grain structure of opaque objects, such as metals, to an order of minute detail never before realized. According to Dr. Zworykin, the full range of its possible uses can not be judged at this time.

In the ordinary electron microscope, the electron beam, like the light in an optical instrument, throws an image of all parts of the object simultaneously on the fluorescent screen. In the scanning instrument, the beam is narrowed down to a spot no more than 1/2,000,000 inch (100 Angstrom units) in diameter—about 1/1,000 the size of a pin point. This tiny spot sweeps back and forth over the specimen, itself only a fraction of an inch in size, scanning it as in a television transmitter, and builds up the image on the fluorescent screen in successive parts. Great difficulties were encountered in obtaining and handling this sub-microscopic spot. In the present arrangement, the light from the fluorescent image, now ordinary light, is concentrated by an optical lens on the photo-cathode of an electron multiplier which in turn operates a facsimile printer. This form is adapted to metallurgical studies.

At the recent meeting of the American Physical Society at Pennsylvania State College, Hillier, R. F. Baker and Zworykin announced another major improvement in electron microscopes, an adapter by which the conventional instrument can be quickly converted into a diffraction camera to reveal the molecular structure of a specimen, without interfering with the normal operation of the instrument as a microscope.

FOAM GLASS

BREAKING a bottle-neck caused by the shortage of cork, a new kind of glass that floats on water is about to be used in life preservers, life rafts and life boats. It is a black, non-transparent material that does not at all look like ordinary glass. Weighing only 10 pounds per cubic foot, Foamglas, as it has been named, is being produced in a large factory in western Pennsylvania by the Pittsburgh Corning Corporation.

The new floating glass has a cellular structure but each tiny cell is airtight. For that reason the material is permanently buoyant in water and has high insulating value. It is rigid rather than resilient, and can be sawed or drilled with ordinary tools.

It is expected to serve in place of such scarce imported materials as balsa wood, cellular rubber and kapok as well as cork. Foamglas has the added advantages of being odorless, fireproof and vermin-proof. This light-weight glass is made by a process that resembles the way in which yeast or baking powder raises bread. Ordinary glass is mixed with a small quantity of pure carbon.

When the glass is heated to a certain point it softens and the carbon combines to form a gas that puffs up the molten mass to one-fifteenth the weight of ordinary glass. Exact time and temperature control is necessary to obtain rigid vitreous slabs with cells uniformly small and sealed one from another.

Since 1938 this new product has been under development in the research laboratories of Pittsburgh Corning Corporation, jointly owned by Pittsburgh Plate Glass Corporation and Corning Glass Works.

In addition to going to sea as the buoyant element in life-saving apparatus, the new glass is to be marketed as insulation in the cold rooms of meat-packing plants, breweries, dairies and ice cream plants. It will also be used in floats that support pontoon bridges.

THE SPONGE IRON PROCESS

THE world's oldest process of smelting iron will go into service in the present war effort as soon as small scale pilot plant operations are expanded. This sponge iron process, the subject of Congressional discussion, is considered practical by experts of the U. S. Bureau of Mines. Because it can use low grade ores it is urgently needed to meet the shortage of iron scrap.

Whether the process is cheaper or more expensive than others, whether it is superior or inferior, is beside the point. We need the metal. We must have it to feed our starving furnaces, especially the open hearth furnace for the production of low carbon steel for shipbuilding and other vital purposes. The sponge process will not replace the blast furnace. It will supplement it.

Two dozen or more individuals and concerns, including the Bureau of Mines, have been experimenting with the process. Only now has it had a real pilot-scale test. Small plants are successfully using it all over the world.

This so-called sponge iron process is the first by which man smelted iron from its ores. The ore was intimately mixed with charcoal in a small furnace or even on a forge. Air was blown in by a bellows. The temperature reached, 1,400 to 1,500 degrees Fahrenheit, was not sufficient to melt the iron, which gathered in a spongy or powdery mass at the bottom of the furnace. These characters were due to about 50 per cent. slag. This was afterwards hammered out of the metal, which was called wrought iron. There was also much loss due to oxidation. Some improvement was made by adding a limestone flux. All the iron and mild steel produced in ancient and medieval time up to the middle of the 14th century was produced in this way. Then the blast furnace was invented. This was nothing but a bigger furnace with a better blast operated by water power. About 1612 a further improvement was made by substituting coke for charcoal, motivated at first by the fact that England was being denuded of her forests by the voracious iron furnaces.

In the blast furnace a temperature of 2,700 degrees Fahrenheit or more is reached. This melts the iron, and the product is cast iron. Long after the introduction of the blast furnace, however, wrought iron was still preferred to cast iron, for cast iron is brittle and wrought iron is ductile. Nowadays it does not matter what way we get our iron, so long as we get it, for metallurgists have learned to change its character, by subsequent treatments and alloying, in almost any way desired. The Bureau of Mines believes that with modern improvements, the old sponge iron process, originally primitive, laborious and wasteful, might become the equal of the blast furnace. The use of the method during the present emergency will ultimately answer that question.

SULFADIAZINE FOR THE TREATMENT OF COLDS

HOPE that with the aid of the sulfa drugs we might get through next winter and succeeding winters with fewer bad colds, attacks of bronchitis and pneumonia, appears in a report by Dr. Morris Siegel, of New York, in the *Journal* of the American Medical Association.

Sulfadiazine, given on the very first day a sore throat or other symptoms of a cold appear, can apparently speed recovery and prevent the cold from developing into pneumonia or into an attack of bronchitis severe enough to keep the patient in bed or maybe send him to the hospital.

Dr. Siegel gave this treatment, during an epidemic last winter, to a group of feeble-minded children who were particularly susceptible to colds and other infections of nose, throat and lungs. As controls, half of the children in each of the same two cottages at Letchworth Village were not given the sulfadiazine treatment the first day they showed symptoms, although all of them were given such ordinary care as their symptoms required.

"Most of the patients receiving sulfadiazine improved after 24 hours," Dr. Siegel reports. "A few had a secondary rise in temperature within 72 hours after premature withdrawal of the drug and some showed no evidence of improvement.

"For the first 12 hours after treatment was begun there was often no perceptible difference between the treated and control cases. Within 24 to 36 hours, however, there were usually signs of improvement in the treated group. The temperature fell and remained low. The patient appeared less toxic. His appetite returned and he was no longer restless and apathetic but brighter and more cheerful. Signs of infection, such as coryza (running nose) and cough, still persisted in many cases but the infection appeared to be subsiding, as if the inflammation had abruptly passed the acute stage."

During a second epidemic of a milder kind of infection, the sulfadiazine treatment did not seem to have much effect. This, Dr. Siegel believes, is probably because the second kind of infection was caused by a virus, which was not susceptible to the action of sulfadiazine. This suggests that effective control of colds, bronchitis and the like by sulfa drug treatment would depend on whether or not they were caused by germs of the kind that can be overcome by the drugs. Since germs of this kind are believed to be the cause of many of the worst symptoms of colds and the reason for colds lasting so long and so frequently ending in pneumonia, the chances seem bright for the sting of the common cold being drawn by the sulfa drugs.

CHOLERA AND THE SULFA DRUGS

HOPE that deadly Asiatic cholera can be conquered by

sulfa drugs appears in a report by Dr. James J. Griffitts, of the U. S. National Institute of Health. A single injection of sulfadiazine or sulfathiazole saved 50 per cent. of mice inoculated with enough cholera germs to kill 90 out of 100 untreated animals in 24 hours. From 80 per cent. to 90 per cent. of the treated animals survived the first 24 hours, 50 per cent. surviving for the 7-day test period.

The sulfadiazine and sulfathiazole were effective whether given by injection under the skin or into the stomach. Two other sulfa drugs, succinyl sulfathiazole and sulfaguanidine, were also effective when put directly into the stomachs of the cholera-infected mice.

India is the original home of cholera, but the disease can spread far along lines of travel and troop movements unless checked by rigid sanitary precautions. It is caught by drinking contaminated water or eating food contaminated with the vibrant, comma-shaped cholera germs which are discharged with the body wastes from patients or carriers.

Anti-cholera vaccine, which has been ordered for all U. S. soldiers likely to serve in cholera infested regions, gives immunity against the disease for about one year.

AUTOMOBILE OF THE FUTURE

WHEN the cessation of hostilities at last permits the manufacture of automobiles to be resumed, the new cars will be smaller, lighter, lower, cheaper and more economical than present ones, and some radical new designs with engine in the rear may be seen. This is the concensus of engineering opinion as gathered by Frank Jardine, chief engineer of the Castings Division of the Aluminum Company of America, published in the *Journal* of the Society of Automotive Engineers.

The first post-war autos will probably be similar to the 1942 models, and more expensive. Time will be required to develop the drastically changed new models, and meanwhile parts, tools and machinery already on hand will have to be used. Nor may we expect new cars to run off the assembly line the moment hostilities cease. Time is also required to change from war-time to peace-time production.

Here are some of the ideas of automotive engineers regarding the future car. But Mr. Jardine states that future events may require some considerable revision of present-day ideas.

While every one was agreed that the new cars would be cheaper, there was much variation as to actual prices. In the low price range, the average was $700 for a car that would do 30 miles on a gallon of gas. The larger cars averaged $2,000 and 20 miles to a gallon of gas. These economies would be required to offset higher gas taxes. Regular fuel would be 80-octane, premium fuel 100-octane. Weight of the cars would be reduced by as much as 1,000 pounds in some cases without reducing size.

It is believed that there would be extensive use of substitute materials developed during the war, with savings in weight and cost and in many instances with mechanical improvement. Increased production of aluminum and magnesium would permit greater use of these light-weight materials. Plastic windshields curved at the corner posts will permit better seeing. Tires will be about the same but may be of synthetic or natural rubber. Hydraulic drives and brakes, automatic transmission and overdrive will definitely appear on all but the low-priced models. Engines will be smaller and lighter in weight. Carburetors will probably not be changed, but superchargers and fuel-injection systems may be developed. Eventually the engine may be placed in the rear.

ITEMS

RUBBER-LIKE substances, with at least part of the stretch and bounce of real rubber, have been prepared from soybean and corn oils at the Northern Research Laboratory of the U. S. Department of Agriculture at Peoria, Ill. Some of these products will stretch 200 per cent. or more and return to original shape; they show tensile strengths of about 500 pounds per square inch. Natural rubber averages a 600 per cent. stretch, with a tensile strength of 3,000 pounds or more. The substitutes are thus only approximations of real rubber in these respects. However, they may be able to do part of rubber's job in such things as waterproofing, resistance to abrasion and cracking, etc. In these ways they may be able to eke out the country's short supply of natural rubber.

DEHYDRATION, the process that makes one ship do the work of half-a-dozen or more in getting vegetables, eggs and milk overseas, is now at work on meat as well, according to an announcement made by Secretary of Agriculture Claude R. Wickard. Experiments have been under way for some time, and the technique has progressed far enough to justify its use with beef. Experimental work on pork dehydration is still in progress, and is regarded as promising. The beef is ground before dehydration, so that the product, after "re-hydration," is most suitable for meat loaf, meat pie and croquettes. A coarser grind gives meat suitable for stews. The product is reduced about three fourths in weight, and about half in bulk. At present, production is limited, for existing plant capacity is only about a hundred tons a week. Demand is far in excess of this.

"THE night has a thousand eyes" is strikingly true to-day, for all over the world amateur variable star observers are keeping their vigil of the stars known as variables. This is reported by Leon Campbell, recorder of the American Association of Variable Star Observers. The light variations of the unpredictable star called SS Cygni have been watched continuously since the star's discovery by Miss L. D. Wells, at Harvard, in 1896. Since then, nearly 60,000 estimates of this star's brightness have been received, representing the observations of over 500 observers, some of whom have watched the star for 20 years or more. Normally a 12th-magnitude star, about every 50 days SS Cygni bursts forth and becomes 20 or 30 times brighter, reaching nearly the 8th magnitude. Over 330 such outbursts have been recorded, some lasting only a few days, while others stretch over several weeks. But in 1933–34, the star decided not to follow its usual pattern at all. SS Cygni is a mystery to astronomers, who are seeking an explanation for its peculiar behavior.