by bombarding them with the radiations shot out from the heavier radioactive elements.

The experiment of Drs. Cockroft and Walton was not the first that obtained greater energy from an atomic transformation than was put into it.

Prof. W. Bothe, German physicist, reported a few months ago that he bombarded beryllium metal with alpha radiation or helium hearts from radioactive polonium and turned it into carbon, observing gamma rays that might be called artificial cosmic rays to be emitted with more energy than was put into the operation. This advance, reported exclusively by Science Service in a signed article by Prof. Bothe, was hailed as the first successful synthesis of matter and the first atomic transformation that yielded a gain in energy.

Upon the basis of such experiments, the hope of obtaining "something for nothing," that is, getting more energy out of matter than is put into it, is due for a revival. Practical transmutation of one element into another has caught popular and scientific imaginations since the days when chemistry was alchemy. While there is little hope of turning lead into gold or synthesizing hydrogen into helium with a gain in energy that would do the work of the world, the new atomic researches promise to tell more about the way matter is put together. Eventually the syntheses and disintegrations may be put to work, but this will probably take years and decades. In the Bothe experiments only one in fifty thousand of the projectiles hurled hit its mark and the process as a whole is dreadfully inefficient although when hits are made energy is gained. In the Cockroft-Walton experiments for every atom disintegrated several millions of particles were required.

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BACTERIOLOGY

Bacteria Exploded in Making Of New Type of Vaccines

BACTERIA, blown to bits by the sudden release of carbon dioxide that has been literally squeezed into them under a pressure of 800 pounds per square inch, are being used to make vaccines of a new type, without the use of heat, by David Crowther, a New York scientist. Advantages claimed for the new vaccines are that they are more effective and keep better than vaccines made with the use of the heat.

The physical principle involved is exactly the same as that which causes a bottle of pop to "fizz" when the cap is removed. The gas has been introduced under pressure and has gone into solution. When the pressure is released the gas comes out of solution and explodes in bubbles. The same sort of thing happens when grains are "puffed" to make breakfast foods; though here the exploding force is that of steam. Only the bacteria "pop" much more thoroughly than the grains do; they lose any semblance of bodily form and release their protoplasm into colloidal suspension, like white of egg stirred up in water. In this form, the substance of the bacteria has the power to provoke the tissues of organisms into which it is injected to form protective substances or antibodies, just as ordinary vaccines do. While the process is still in the experimental stage, large quantities of vaccines have been made and the experiment continues.

The same process of "popping" living organisms with a gas that dissolves in their tissues under pressure has been used by Mr. Crowther for the destruction of insects and their eggs and larvae, especially species that infest stored products. Possibilities of its use on a commercial scale are seen, where heat or chemical extermination of such pests are not practicable. For example, it is pointed out, neither heat nor chemicals will readily penetrate a package of flour, a bale of cotton or a bag of seed, but such materials, subjected to the pressure of a gas, are readily and completely penetrated.

Spores Not Killed

When the gas pressure is released, temperature is reduced somewhat; but since most of the products that might be treated by this method are not harmed by moderate degrees of cold this does not constitute a serious objection.

The new method is not universal in its applicability, however. Bacterial spores, which are highly resistant resting stages of some species of bacteria, are not killed by it. Yeasts, which often damage food products by starting undesired fermentations, are also difficult to destroy.

Carbon dioxide is not the only gas that can be used, it is pointed out, but it is best in most cases because it is more soluble than other easily obtainable gases, such as hydrogen or nitrogen. For a given working pressure it will therefore have considerably greater effect.

Science News Letter, May 14, 1932

AVIATION

Navy Airplanes To Be Free of Carbon Monoxide

ALL NEW airplanes built in future for the U. S. Navy will be tested at the factory for the presence of carbon monoxide in the cockpits, and if this deadly gas is found, even in minute quantities, it must be eliminated before the planes will be accepted.

This new requirement is the result of an investigation into the hazard of the pilot from the exhaust fumes of his engine, conducted by Dr. Joel J. White, of the division of aviation medicine of the Navy.

Blood tests of pilots after flights revealed that the highest concentration of carbon monoxide in the blood, 15 per cent. of saturation, was not sufficient to cause unconsciousness, but was enough, if continued over a long period, to have a bad effect on the pilot's health and efficiency. Exposure to a low concentration over a long period is more harmful than a brief exposure to a very high concentration.

A comparatively simple and inexpensive modification of the exhaust leads serves to eliminate the gas from those parts of the plane where it might be breathed by the pilot or passengers.

An interesting feature brought out by the investigation, which is reported in full in a current issue of the *U. S. Naval Medical Bulletin,* is that exposure to the gas was greater in open cockpit planes than in the types with closed cabin.

For convenience in testing for the presence of carbon monoxide, the Bureau of Medicine and Surgery of the Navy in cooperation with C. E. Earle, Navy chemical engineer, and the Mine Safety Appliances Co., developed a new type of carbon monoxide indicator which makes use of a chemical "hopcalite."

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