PHYSICS

"X-Ray Microscope" Invented By Nobelist W. L. Bragg

Instrument Now Being Perfected May Be Useful Aid In Crystal Analysis, Of Importance in War Research

AN "X-RAY microscope" invented by Prof. W. L. Bragg of Cambridge University's Cavendish Laboratory, is the newest instrument for peering into the innermost structure of matter. By its means can be seen the actual arrangement of the atoms in one layer of the crystal.

The instrument is not yet fully perfected and at present applies to only one special case. But Prof. Bragg hopes to extend its applications and believes that it will then be a useful aid in crystal analysis.

The X-ray analysis of crystal structure, which won the Nobel prize for Prof. Bragg and his father, the late Sir William Bragg, is of immense importance in all branches of both war-time and peace-time industrial research. On the crystalline structure depends the strength of steel girders, the toughness of armor plate, the hardness of tool steel, the properties of aluminum alloys, the lubricating qualities of paraffins and of graphite, the stretching of rubber, the covering power of pigments, in fact, nearly every aspect of the behavior of a solid substance.

But X-rays passing through a crystal do not directly reveal its structure. They produce a "diffraction pattern" of complicated design from which the positions and spacings of the atoms must be calculated. This gives the arrangement in a particular plane. To get the true arrangement in space, several such patterns must be photographed by passing the rays through the crystal in different directions. A three-dimensional model can then be made. This is a long and laborious process.

Instead of making a drawing showing the arrangement in a particular plane, Prof. Bragg's apparatus forms an optical image of it which can be viewed through an ordinary optical microscope. (The name "X-Ray Microscope" applies to the whole apparatus.)

He drills a number of small holes through a brass plate. The sizes and arrangement of these holes are determined by the diffraction pattern. The plate is placed in the path of a beam of ordinary parallel monochromatic light. This light in passing through the small holes produces a diffraction pattern of its own which, however, on account of the carefully calculated sizes and spacings, is a replica of the arrangement of the atoms in the crystal, each spot representing an atom. The image is focussed and viewed through the microscope.

Thus, X-rays passing through a crystal are diffracted by the structures they encounter, but produce a pattern bearing no resemblance to this structure. By rediffracting this pattern backwards, so to speak, with ordinary light, Prof. Bragg obtains a visible image of the atomic arrangement that produced it.

To get a good image, the holes in the plate must be accurately dimensioned and spaced to better than half a wavelength of the light used. On account of the difficulty of this, Prof. Bragg has lately devised an improved method. An enlarged drawing is made in which the holes are represented by solid black circles. This is then photographed and reduced to the proper size, the black circles being in effect converted to transparent holes. The use of this in place of the brass plate gave much better definition.

The new method was reported to the British science journal, *Nature,* with photographs made with the "X-ray microscope," and drawings of the same crystal structure calculated from X-ray diffraction patterns, showing close correspondence between the two.

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MEDICINE

Beef Blood May Save Lives Of Wounded Fighting Men

BEEF blood from the nation's slaughter houses, now thrown away at the rate of millions of gallons yearly, may be used in future to save the lives of wounded soldiers and sailors, Dr. A. Newton Richards, chairman of the Committee on Scientific Research of the Office of Scientific Research and Development, said on a Science Service radio talk over the Columbia Broadcasting System.

Scientists at Harvard University, he said, are working intensively in the effort to prepare beef albumen in such a form as to be harmless when injected into man. Albumen fights shock because of its ability to hold the fluid in which it is dissolved within the blood vessels. In shock, the blood vessels lose their capacity to keep blood and other fluid inside their walls.

Albumen from human blood has already been used effectively in fighting shock in civilian hospitals. A supply was taken to Pearl Harbor and used with dramatic results in the treatment of seven patients, two of whom were regarded as hopeless because of shock caused by extensive burns.

Science News Letter, June 6, 1942