SCIENCE NEWS

QUARTZ WINDOWS AND THE SUNLIGHT

Science Service

REAL sunshine indoors is the possibility held out by Dr. Edward R. Berry, assistant director of the Thomson Research Laboratory of the General Electric Company, as the result of the perfection of a process for making fused quartz. Glass windows keep out the healing and stimulating ultra-violet rays of sunshine. Quartz, or rock crystal, lets them through; and, if windows were made of quartz, people could enjoy indoors exactly the same sunshine they would get under the open sky.

The results of Dr. Berry's researches were briefly announced at the recent meeting of the American Philosophical Society in Philadelphia, and on April 29 a party of newspaper men was taken through the research laboratory at Lynn, Mass., and shown samples of various forms of the fused quartz, which, according to the inventor, is likely to revolutionize optical industries.

Rock crystal has been known from ancient times, and that it can be fused has been known for nearly one hundred years, but Dr. Berry is the first to develop a practicable method, suitable for development into commercial applications although development in that direction has been limited so far. The trick is in the use of a special type of electric furnace for the melting of the quartz, in which the heat is furnished by the electrical resistance of a carbon cylinder, within which the graphite crucible is contained.

The raw material is rock crystal of high purity, and this is melted in the furnace under much reduced atmospheric pressure so as to remove the maximum amount of air and other impurities. The fused quartz, at a temperature of close to 2,000 degrees Centigrade, or about 3,600 degrees Fahrenheit, is then squeezed out through holes either by pressure or its own weight and formed into rods or tubes, or it is cast into blocks or other shapes desired. Blocks a foot long and several inches thick were exhibited.

Possible applications of this new product may be seen from a recital of some of its more important characteristics. First, it transmits light almost completely without shutting off either the life-giving ultra-violet or the heat-giving infra-red rays. It makes easily possible the medical use of ultra-violet light either by indoor exposure to sunshine, or by the use of mercury vapor lights in quartz bulbs. Light travels down a rod of quartz much as water down a tube. Little is reflected out of the sides. So it is possible to put a source of ultra-violet light at one end of a small glass tube or rod, and transmit it almost unimpaired to the interior of the body. Ultra-violet light has been known to be fatal to the germs which cause such diseases as pyorrhea, nasal infections, and similar morbid conditions, and the light can be turned on just where it is needed.

Fused quartz can be heated to bright red heat and then plunged into ice water without cracking or injury of any sort. This is because it expands so little with heat, only .6 of a thousandths part of its length for a rise of 1,000 degrees Centigrade. This makes it valuable for use in telescope lenses, or in the projection lenses for motion pictures where the lenses are exposed to great heat from the electric light. Quartz lenses are already being used in movie theaters.

More accurate thermometers may be made of fused quartz than of glass. Dr. Berry took a glass thermometer and a quartz one, heated them both nearly to redness and then cooled them to the temperature of ice water, with the result that the quartz instrument was still accurate while the one made of glass showed big errors.

Quartz is silicon dioxide of which a large part of the crust of the earth is composed, but, so far, it has not been found practicable to make the fused quartz from anything but rock crystal, which, however, is fairly abundant and cheap. To make the highest quality of optical quartz it is necessary to remelt the quartz under a pressure of about 600 pounds. This compresses any bubbles remaining in it so as to make them of insignificant size. This quality has not as yet been placed on a commercial basis, but as to the ultimate outcome, Dr. Berry was decidedly optimistic, saying "I believe that eventually everything now made of glass may be made from quartz."

As for the immediate future, Dr. Berry exhibited a block of fused quartz, a foot long, which will be sawed by diamond saws into window panes for use in a children's clinic in a large hospital. The ultra-violet rays of sunshine cure rickets and tuberculosis, and the quartz panes will let all the sunshine into the bodies of the children without exposing them to the chill of out of doors.

EINSTEIN'S THEORY AND THE SHIFT OF THE SOLAR SPECTRUM

Science Service

EINSTEIN'S third prediction, that the spectrum of the sun is shifted slightly toward the red end as compared with light from the earth, is not borne out by experimental evidence presented to the National Academy of Sciences at its annual session by Dr. Heber D. Curtis, director of the Alleghany Observatory, Pittsburgh.

This negation of one of the important points in the Einstein theory of relativity stirred the scientists because Dr. Charles E. St. John, of the Mount Wilson Observatory, California, at the same session presented evidence in favor of Einstein's prediction of the effect of the gravitational field of the sun upon the light emanating from it. Dr. St. John made a preliminary announcement upholding Einstein last fall.

Dr. Curtis explained that the very minute shift toward the red end of the spectrum required by the Einstein theory amounted to only about eight thousandths of an Angström unit, roughly two one-millionths of the wavelength of the light.

The accuracy of the measurements made by Dr. Curtis with the cooperation of Dr. Keivin Burns, of his staff, and Dr. W. F. Meggers, of the National Bureau of Standards, is more than ten times that of this predicted shift. The apparatus used was a combination of an interferometer with a powerful grating spectrograph applied for the first time to a systematic investigation of the solar spectrum.

The measurements show shifts of the spectrum, but they are of a complex nature rather than the simple and uniform amount predicted by the relativity theory.

"Instead of all the solar lines being shifted by an equal amount to the red," Dr. Curtis said, "and instead of that amount being the quantity predicted by Einstein's theory, a very marked line-intensity factor is found. For the very faint solar lines there is little, if any, shift, and the amount of this shift increases as the wider and stronger lines are used."

For a solar line of very weak or 0 or 1 intensity the shift to the red amounted to only two ten-billionths of a millimeter, while Einstein's prediction calls for a shift of eight ten-billionths of a millimeter. In the case of very strong lines or those of 15 intensity, the shift was nearly double that predicted by Einstein, or fifteen ten-billionths of a millimeter.

"There is thus seen to be an unmistakable progression in this shift, which must be due to some factor or factors other than relativity, and it does not seem possible to reconcile these results with that theory, for the theory requires that all solar lines be shifted to the red by a certain amount, while our results show that the very weak solar lines are shifted only one quarter or less of that amount. That is, if the relativity prediction is true, we must postulate some cause to shift the very weak lines back toward the violet. Now, while various causes may shift spectrum lines to the red, there is no known case of anything shifting them to the violet, except velocity, which seems untenable in this case."

On the other hand, Dr. St. John holds that the shifting of the lines of the solar spectrum are in the main satisfactorily accounted for by the Einstein theory of relativity, and that the minor deviations from the theoretical displacement observed in the rays coming from the high and low levels of the solar atmosphere are due to the motion of the currents of the hot gas. In the outer atmosphere the cooler vapors, which are settling downward, and therefore drifting away from us, cause a shift of the lines toward the red, in addition to the Einstein effect. While in the lower levels of the sun's atmosphere, three fourths of the light is emitted by the hotter rising gases, and this motion toward the earth produces a shift toward the violet which tends to reduce the Einstein effect. Recent observations made on Mt. Wilson show that there are upward and downward convection currents of incandescent gases in the stars, like those in the sun, but a vastly greater velocity.

BALLOONS TO STUDY THE SPREAD OF INSECTS

Science Service

Dr. E. P. Felt, chief entomologist of the New York Conservation Commission, announces that thousands of toy balloons will be released early in May from fifteen temporary weather stations located along a wide front extending from northern Connecticut nearly to the Canadian border in an effort to discover the secrets of the winds responsible for the westward spread of the tree-destroying gipsy moth.

The gipsy moth has proved such a destructive insect in New England and New York that the State Conservation Commission, in cooperation with the federal government, has established a barrier zone in an attempt to stop its westward spread. In spite of the fact that this pest is a winged insect, it does not occupy new territory through its power of flight. The females are unable to fly on account of the extreme weight of their bodies. The big spread comes when the young caterpillars are first hatched from the eggs. These caterpillars have long hairs growing out of their bodies. These hairs, it is thought, together with the silk which the caterpillars spin help to buoy them up in the wind which sometimes carries them from a half mile to five miles from their starting place.

Last year, to learn about the winds which caused this gradual spread of the caterpillar aeronauts, 7,000 hydrogen-filled toy balloons were sent up. Each balloon bore a numbered tag requesting the finder to return it with a record of the time and place where found. Over 400 tags were recovered by the end of the season. They were found practically throughout southern New England, a number being picked up on both the eastern and southern coasts. One balloon was found off Yarmouth Cape, Nova Scotia, a drift of about 400 miles in 18 hours. Seven covered distances of 110 to 145 miles. One drifted 65 miles at the rate of 100 miles an hour. Another remained in the air six and a quarter hours and then dropped at the point of release evidently carried back by a counter current. One season's work was thought insufficient to justify definite conclusions with such variable factors as the winds, and the investigations are to be continued this spring on a more extensive scale.

THE ARCHITECT OF THE NEW BUILDING OF THE NATIONAL ACADEMY

Science Service

The sudden death of Bertram Grosvenor Goodhue, architect of the new building of the National Academy of Sciences and the National Research Council, four days before the acceptance and dedication of what many competent critics regard as his masterpiece, has shocked and saddened the many prominent scholars and scientists who gathered there to attend the dedication ceremonies. Mr. Goodhue made his final inspection of the building on Tuesday, April 22, expecting to return on Sunday for the dedication on Monday, the twenty-eighth. He died suddenly at his home in New York the night of April 23.

Mr. Goodhue would have been fifty-five years old on the day of the dedication of the new building. He was born in Connecticut and was a member of prominent architectural firms in Boston from 1891 until 1914 when he moved to New York and began the practice of his profession in his own name.

Among the best known examples of his work are some of the new buildings of the U. S. Military Academy at West Point, St. Thomas's Church in New York City and the buildings of the California Institute of Technology at Pasadena, Cal. He also designed the buildings and grounds for the San Diego exposition of a few years ago.

The new building of the National Academy of Sciences and the National Research Council is regarded as one of the finest products of his art.

In it he has utilized to the full the utmost refinements of the purest Greek architecture. Many details, themselves almost unnoticeable, contribute to the notable general effect. He was, for example, extremely particular in the choice of the color of the marble for the exterior of the building, and the courses are laid, not of uniform width, but, following the ancient Greek style, of differing widths so as to break the monotony of the face of the building. Apparently straight lines are slightly curved, and the face of the building is not exactly vertical but slopes slightly inward. All these refinements are in the finest spirit of the work of the Greek masters, and are combined in this building for the first time, so far as is known, in the New World.

The building, which will stand as a memorial to the architect's genius, will be a national center for science and scientists, and the clearing house for the latest news of scientific progress. It faces the Mall and the Lincoln Memorial, the wide waters of the Potomac and the heights of Arlington beyond, as an everlasting witness of the possibility of the union of man's sense of beauty with his quest of the unknown.

A FOG-WARNING DEVICE

Science Service

F. C. HINGSBURG, assistant superintendent of the U. S. Lighthouse Service, at Baltimore, has invented a fog valve which depends for its operation on strands of human hair. The invention is now in use.

The apparatus consists of a brass case containing hygroscopic valve mechanism. Human hair, which has been treated to eliminate oil, grease and all foreign matter, is stretched over two lugs and is pulled up to the proper tension by an adjusting screw. About 400 to 500 hairs combed parallel are used, it being considered that by an increase in the number of hairs more accurate results are obtained.

The hygroscopic device controls the current to a motor which drives the striker of a 1,000-pound fog bell mounted in a skeleton tower. Under the hair element a lever arm is suspended. There are two contacts in the electrical device, one being dry and one moist.

As the humidity approaches 96 per cent. the hair stretches and the lever arm drops, engaging a trip which breaks the dry contact and makes the moist one. The current through a relay is switched on to the motor which operates the striker.

As soon as the hair dries off after the fog is lifted, the moist contact is broken and the dry contact again made, which switches off the motor through a relay.

The contact control is not limited to fog bells, but may be used for all types of electric signals including the electric siren and various kinds of electrically operated horns.

In isolated locations where power is not available, it is necessary to resort to the energy of compressed gas. For lighthouse purposes the energy of compressed carbonic acid gas is used.

The fog valve acts as an alternate to the sun valve invented by Nils Gustaf Dalen, a Swedish farm boy, who won the Nobel prize for his invention. The sun valve operates on the principle that heat expands metals. His device lights electric bulbs or gas lights at night, and extinguishes them in the morning. In it four metal rods are exposed to the sun's heat. One is covered with lampblack and connected with a valve. The sun's rays heat this rod which is connected to a valve controlling the current or the flow of gas.

ITEMS

Science Service

THE derelict schooner, *Governor Parr*, after several months of obscurity in the North Atlantic, is again causing steamship captains some anxiety. The recent shift in the steamer lanes to the southward to avoid icebergs has brought this floating wreck into their path. The *Governor Parr*, a four masted schooner, has had one of the longest drifts of any derelict in recent years. Abandoned in a partially dismasted condition on October 3, 1923, about 350 miles east-southeast of Halifax, the vessel has been reported about 14 times since and is now almost in mid-Atlantic some 600 miles east of the Grand Banks. The drift amounts so far to approximately 1,000 miles in a straight line although the actual path is highly irregular and much longer. Attempts have been made to sink the derelict or tow her into port, but being lumber-laden she is practically unsinkable and is now too waterlogged to tow. Her last position when reported was latitude 45, and longitude 35 degrees, 30 minutes, on April 12.

A PIN was dropped on a desk by Dr. Gano Dunn in the course of his address at the dedication of the new building of the National Academy of Sciences and the National Research Council in Washington. That pin-fall was perhaps the most significant and widely heard of any in all history. Without being warned to silence, every person in the high-domed, wide-winged hall plainly heard the pin as it struck the woodwork. Thousands of radio listeners, hundreds of miles away, also heard. Specially designed artificial stonewalls made the sound clear, distinct, without those hollow echoes which characterize high vaulted buildings of the past. That pin-fall sounded an engineering triumph in the long-neglected science of acoustics.

A GREAT irrigation project, involving the storage of 80,000,000,000 cubic feet of water, has been planned in Southern India. The water will be taken from the Cauvery River and distributed to 300,000 acres.

ELECTRIC currents may be induced by applying mechanical pressure to gelatinous surfaces and this "mechano-electric" effect is supposed to be of great importance in explaining many electric effects in living organisms.