SCIENCE NEWS

Science Service, Washington, D. C.

PHOTOGRAPHIC DETERMINATION OF THE BOILING POINT OF METALS

THE application of a new type of scientific camera that adds another "dimension" in its pictures to the problem of determining the temperatures at which various metals boil, was described at the Fifth International Conference on Spectroscopy, held recently at the Massachusetts Institute of Technology, by David Richardson, of the American Cyanamid Company. Perfection of the camera and its ability to detect tiny traces of elusive elements were announced by Mr. Richardson at last year's conference. Essentially, the new camera is an improvement on the spectroscope and the major feature is the use of a moving photographic plate.

The ordinary type of spectrum picture, made of the light given off from the atoms of the substances under analysis, is snapped in a manner to a large extent resembling that used in taking ordinary snapshots. By using a moving plate, however, instead of a stationary one, Mr. Richardson added the extra dimension, for the moving plate makes it possible for him to tell exactly what was going on at any instant during the exposure. It is virtually as big an improvement over the ordinary spectroscope as moving pictures were over the old-fashioned stereoptican. It is this advantage of the new technique that Mr. Richardson has utilized to determine the boiling points of metals. When the plate is moved during the time of the exposure, that an element is in the arc can easily be determined by the location of the beginning and the ending of the spectrum lines of that element in the picture.

It was found that those elements having low boiling points would appear early while those with higher boiling points would need more excitation to cast their lines and would appear later. Thus it is possible to arrange all the spectroscopic elements in order, in accordance with the time they appeared in the picture, and hence according to their boiling points. Correlating these data with boiling points of elements for which this property was known, Mr. Richardson has completed a comprehensive table of the boiling points of various elements that is expected to be of considerable aid to all investigators working in this and related fields.

The chief advantages of the new method are the exceptionally small sample of a metal needed for the investigation, the permanent record obtained, the certainty of identification of various elements, regardless of others present at the same time, and the large number of elements which can be studied simultaneously. By way of illustrating the tremendous temperatures with which Mr. Richardson worked, here are some of the boiling points he found: cobalt, 3,350 degrees Centigrade; rhodium, 4,500 degrees; titanium, 5,100 degrees; rhenium, 5,900 degrees. As guides, Mr. Richardson used these previously determined boiling points which checked remarkably well with his tables: iron, 3,200 degrees; platinum, 4,530 degrees, and tungsten, 6,700 degrees.

THE SPECTROSCOPE IN THE DETERMINATION OF MOLECULAR STRUCTURE

INVISIBLE light is being used to solve the structure within the molecule of the atoms of which all matter is composed. This was discussed before the conference on spectroscopy by Dr. R. B. Barnes, of the American Cyanamid Company. Among the vital questions science may be able to answer from knowledge gained in this research are: What happens when rubber ages, how some petroleum products differ from others, what takes place when a film of paint dries and what is the effect and action of various catalysts.

In his research, Dr. Barnes uses the spectroscope to examine the invisible light found in the infra-red range of the spectrum; he can not only tell what and how many atoms of an element are present, as can be done in all ranges of the spectrum, but how these atoms are connected with each other, as well. The investigation is expected to be particularly valuable in determining what actually occurs during chemical reactions, for the spectroscope can reveal atomic linkages both before and after the reaction. It will also enable investigators to differentiate between isomeric structures. These isomers, Dr. Barnes explained, while difficult to differentiate by chemical analyses, reveal different sets of spectral lines as proof of their individuality.

Since infra-red light can not be seen, but is measured by its heat, a delicate thermocouple transforms this heat into electricity, so that the light can be "read" from a galvanometer. Chief feature of the spectrograph used is that the prism employed to break the light into the familiar spectrum is merely a large single crystal of rock salt. This is used in place of the ordinary glass or quartz prism because of its superior ability to transmit infra-red rays.

Infra-red spectrum research is difficult and tedious because of the delicate and specialized technique and equipment required. To make one complete measurement of a given compound, for example, often requires that the experimenter sit in one position for from five to seven hours. The most recent instrument constructed by Dr. Barnes is completely automatic, however, and has cut this time to less than an hour. An idea of the sensitivity of the experiments can be gained from the fact that temperature changes as small as one ten-millionth of a degree Centigrade must be measured.

THE WIDE USEFULNESS OF THE SPECTROSCOPE

THE discovery of red color pigments that make hams turn red when cured, improved methods of detecting impurities in cast iron, vital information that should yield better rayons and applications that are supplying new facts about gland secretions are among the diversified uses of the spectroscope described by scientists on the program of the International Conference on Spectroscopy.

Dr. G. O. Langstroth, of McGill University, outlined

his spectroscopic methods of analyzing the secretion of glands in the body under varying kinds of stimulation: how the ability of the spectroscope to study small samples of saliva, for example, has enabled him to find that in the cat a different type of protein material is liberated when the salivary glands are excited by adrenalin than when stimulated by the chorda tympani nerve, the small nerve at the base of the brain. This discovery was followed up chemically by the use of large quantities of the secretion and found to be correct. The studies have made possible the formulation of a mathematical theory of secretion that gives a fairly comprehensive picture of certain glandular functions and permits calculation of many features not observable in a critical experiment.

Another biological application of the spectroscope, described by Dr. W. M. Urbain, of the chemical laboratory of Swift & Company, is to learn more about the color changes occurring in the curing of meats. Why, for example, a fried steak or a roast of beef will turn brown, while ham, corned beef and frankfurters remain red, or pink, on cooking. The color of food, he emphasized, is important economically, for there is a psychological appeal to good looking meat that makes customers want to buy it. Meat packers now add constituents to the curing stage which determine the final color of the meat. But the process is not too well known chemically. The spectroscope, said Dr. Urbain, is now helping to find out what happens when a ham or other product is cured. Already several complex, natural pigments have been isolated and some of their properties determined.

By a more accurate spectroscopic analysis of the caustic liquors that go into its manufacture better rayon should be developed, according to Drs. O. S. Duffendack and R. A. Wolfe, of the University of Michigan. So high a standard of purity is now required of common elements used in this industry that ordinary chemical methods are not good enough.

Dr. R. A. Sawyer, also of the University of Michigan, described new and speedier methods of studying impurities in cast iron and in steel which can detect the presence of chromium in one part in 10,000.

THE CARBON DIOXIDE CONTENT OF THE AIR

EVEN though man has released into the atmosphere some 180,000,000,000 tons of carbon dioxide gas by the burning of mined fuel during the last half century, the plants of the world each year return this carbon dioxide a thousand fold through their decay or combustion.

Dr. Robert E. Wilson, president of the Pan American Petroleum and Transport Company, who reports this result in *Industrial and Engineering Chemistry,* also notes that the fears of those people who shudder at the "greatly" increased carbon dioxide content of the air which is produced by modern industrial activity, are unfounded. If all the carbon dioxide dumped into the atmosphere in the last 50 years had not been removed by returning the elements involved to the earth in some form or other, the carbon dioxide content of the atmosphere would have increased only two-thousandths of one per cent. in that time; from 0.03 to 0.032 per cent.

The controlling factor which determines how much carbon dioxide there is in the air is the water of the earth's oceans. Available data indicate there is some 30 to 40 times as much carbon dioxide dissolved in the ocean as is present in the atmosphere. The average partial vapor pressure of this carbon dioxide is probably largely what determines the average carbon dioxide content of the air, so that well over 90 per cent. of any excess carbon dioxide introduced into the atmosphere eventually finds its way into the ocean, leaving the composition of the former virtually unaffected.

The combined result of all our mining and chemical activity to date has made but an infinitesimal alteration in the composition of the earth's crust or sea water. And this, despite the fact that in the past half century some 50,000,000,000 tons of carbon have been obtained as either coal, lignite, crude petroleum or natural gas.

THE USE OF ALFALFA AS A VEGETABLE

ALFALFA, hitherto only known as cattle fodder, has been found by South African biologists to make an excellent and palatable vegetable for human beings. So important is the discovery that large-scale experiments are proceeding for the purpose of adapting it to use in the dietary of native workers in the gold mines of the Witwatersrand.

Dr. F. W. Fox, of the South African Institute for Medical Research at Johannesburg, with Miss C. Wilson of the same establishment, have recorded their preliminary findings in a special report for the Transvaal Chamber of Mines, whose 300,000 black employees are housed in great "compounds" under the control of the various companies. The food for these natives, who are brought from the kraal to civilized areas in order to labor underground, is carefully supervised by the government inspectors and great pains are taken to maintain their health.

The edible part of alfalfa, or "lucerne" as it is called in Africa, is the very tender shoot, but it has been found that mature leaves can also be turned to account.

"Either eaten raw or cooked as a spinach," states an official memorandum, "it is apt to be somewhat fibrous, unless obtained really young and fresh."

Work of the investigators is at present concentrated on the medical side. Several mine hospitals on the Witwatersrand have obtained excellent results through using alfalfa to counteract scurvy among natives, many of whom arrive from the kraal in an undernourished condition. Dried preparations of the alfalfa leaves have been found exceptionally useful, as they contain a "highly concentrated antiscorbutic vitamin." Protein and mineral substances were also found in unusually large quantities. At the outset it is intended to use alfalfa for human consumption in centers where it is difficult to obtain fresh vegetables; already it has been successfully tried in two South African villages in barren regions. Since alfalfa is grown in nearly every part of South Africa, supplies will be available over a very wide area.

THE FIRST HUMAN POPULATION OF AMERICA

AMERICA'S first human population may have become totally extinct, like the mammoths, giant ground sloths,

camels and wild horses they hunted with the stone weapons now known as Folsom and Yuma points. Dust storms may have been a cause of their disappearance. These two points of view are offered for discussion by Dr. C. Bertrand Schultz of the Nebraska State Museum.

The idea of an extinct race of human beings in America is not new. Extinct races were credited with having built the famous mounds of the Mississippi Valley and the Southeast, until research showed that the mound-builders were Indians, and not necessarily the most ancient Indians, at that. But the extinct race postulated by Dr. Schultz might well be as old as the cave-man peoples of the Old World—30,000 years or more. The Indians, or their ancestors, may be a much later-arriving second wave of immigration from Asia by way of Bering Strait. Dr. Schultz says that "Much new evidence strongly suggests that the 'people,' who lived at the same time as so many of these now-extinct mammals, disappeared from the central North American region at the same time as these mammals. Some great catastrophe must have overtaken the animals in that locality at that time."

Many entire families, such as the American horses, camels, ground-sloths, and elephants were wiped out, as well as many genera. The cause of this extinction is not definitely known. Inasmuch as artifacts are often found with now-extinct mammals, it is possible man was a contributing factor in their extermination. Disease is often suggested as a cause. "Dust storms are recognized as a very important element since twice before in the Pleistocene (early Sangomon and early Peorian) great dust storms apparently caused the extinction of some of the mammalian population and drove others to more liveable climates, perhaps to the Southwest or East. If this were also the cause of the later disappearance, a few forms may have lingered on in some localities, but not for any appreciable length of time. None of their bones have so far been found associated with the earliest basket-maker remains of the Southwest nor with the earliest Indian artifacts of the central North American region. The Indians of the Plains may have belonged to an entirely distinct and later migration from Asia or perhaps the people whose ancestors had lived with the mammoth and horse, returned to their former land when the climatic conditions became normal again. But if this latter did happen, evidence points to the fact that considerable time had elapsed between their departure and their return, probably 10,000 years or more."

ITEMS

ALASKA felt a severe earthquake that shook strongly seismographs throughout the world and allowed earthquake experts to locate the shock's center as about 50 miles northwest of Fairbanks. The shock occurred shortly after noon on July 22. Telegraphed data sent Science Service by St. Louis University, the Dominion Meteorological Observatory, Victoria, B. C., and the Seismological Laboratory at Pasadena, Calif., allowed the probable location of the earthquake to be determined by U. S. Coast and Geodetic Survey scientists. The epicenter was probably about 65.5 degrees north latitude and 148 degrees west longitude.

BRAIN waves, those electric impulses that are detected in the human brain itself, are probably not associated with the higher thought processes of man. The same sort of brain rhythms have been obtained from the brain of the guinea pig, according to a report to *The Journal of Comparative Psychology* by Drs. H. H. Jasper, C. S. Bridgman and Leonard Carmichael. This brain wave pattern, known as the "alpha rhythm," is not outstandingly characteristic of the electric messages ordinarily sent out by the guinea pig's brain, but it is possible to record electrical variations which in frequency, regularity and continuity present the same nature as a good record of alpha rhythm from the human cortex. It is concluded that the findings of well-developed alpha rhythms in the guinea pig would lead one to believe that this phenomenon is connected with some basic neurological mechanism, rather than with any higher elaboration of nervous function found only in the primates.

AN improved scarlet fever toxin for protecting children against the disease has been developed by Dr. M. V. Veldee, of the National Institute of Health of the U. S. Public Health Service. The new protective toxin, Dr. Veldee reports in the current *Public Health Reports*, gave immunity or resistance to the disease in more than four fifths of the children vaccinated, as shown by change in the Dick test from positive to negative. The new toxin was prepared by a method which eliminates certain objectionable features of the original material used to protect against the disease. Reactions, such as pain, muscle soreness and temporary illness, were less severe following its use. It is also absorbed more slowly, a feature which scientists believe increases the degree of resistance to the disease.

HEPARIN, a substance of sugary nature that can keep blood from clotting, is produced by a special kind of body cells called mastcells, according to Dr. Hjalmar Holmgren, of the Caroline Institute in Stockholm. Because heparin can retard or check the coagulation of blood, it is much used in experimental work and it is hoped that it will prove practically useful in cases where it is desirable to prevent blood clotting, such as transfusions, and to prevent dangerous blood clots that sometimes occur after operations. It is most easily obtained from the liver and was originally discovered by Dr. William H. Howell of the Johns Hopkins University. The mastcells which Dr. Holmgren believes to be producers of heparin were discovered in 1876 by Paul Ehrlich, who developed the drug that cures syphilis. They have been studied by a number of investigators since then but their function has not until now been known. Mastcells are found in great quantities in the liver and the veins. These cells have the same reactions as heparin when submitted to metachromatic staining with toluidinblue. Dr. Holmgren has studied the proportion between mastcells and heparin in organisms, and found that the proportion is direct, so that in an organism with few or no mastcells there is only a little heparin or a total lack of it.