SCIENCE NEWS

FOG REMOVAL AND RAIN MAKING

Science Service

How fogs are being removed and how rain will be caused to fall by electrically charged sand was explained in a statement made to Science Service by Professor Wilder D. Bancroft, of Cornell University, authority on colloid chemistry, who with L. Francis Warren has been conducting experiments at McCook Field, near Dayton, Ohio.

Clouds consist of drops of water too small to fall at appreciable rate. Drops are kept from coalescing either by being charged electrically and therefore repelling each other or by being covered with a film of condensed air acting like a gelatine capsule. Spraying with positively charged sand will cause negatively charged drops to coalesce and will also remove film of adsorbed air to some extent. The first is the principle involved in precipitating electrically-charged colloids and the second occurs when the crystal detector is used in wireless. The large drops fall and carry down with them many of the finer drops just as the coarser particles of butter fat in milk carry up many of the finer ones when cream rises.

The new process invented by Mr. Warren sprays electrically charged sand from above and consequently gets more results for same expenpenditure of power the thicker the cloud. Experiments at McCook Field show that with eighty pounds of sand charged nominally to fifteen thousand volts a cloud covering two square miles can be dissipated in less than ten minutes. Much better results are expected with sand charged to thirty thousand volts and a more efficient charging nozzle.

Experiments so far have been made in cooperation with the Army Air Service to demonstrate feasibility of removing fogs from flying fields as aviators can neither go up nor come down safely in fogs. Experiments to be made at Moundsville will use a captive balloon one thousand feet up to spray the sand and clear the field. Flying fields can certainly be kept clear and results look encouraging for clearing New York harbor when necessary. Successful preliminary experiments have been made with smokes; but nothing has been done with fogs containing smoke. The problem of removing London fogs seems much less visionary than it did one year ago and is now a question of efficiency.

The Army Air Service is interested in fogs, not rain, and no experiments on rain-making have yet been made. The clouds attacked so far have contained very little moisture. The problem of obtaining rain from heavy clouds should be much easier than dispersing fogs. No claim is now made that rain can be obtained from a clear sky. In many of the arid regions storm clouds pass over without raining. These can undoubtedly be made to rain. With a rain cloud one mile thick the necessary expenditure of power will be the same as with a cloud three hundred feet thick, but the amount of rain will be very much greater. The problem of rain-making and of fog dispersal consists in making small drops into large drops by coalescence and is not a problem of condensation. Since a cloud is an instable mass which should rain but does not, we are not dealing with gigantic forces of nature. The commercial success, if it comes, will be due to the fact that the development of the airplane has made it possible to attack clouds from above and to take advantage of the sweeping action of the falling drops. No one has ever considered rain-making as being colloid chemistry and not meteorology. One distinguished meteorologist pointed out in his book that it was very difficult to see how the drops in a cloud became large enough to fall; but he admitted that it does rain—which nobody can deny.

HOW NATURE MAKES RAIN

Science Service

THE more dust there is in the air, the less chance there is of rain, but the popular idea that dust particles are necessary for rain formation is not altogether wrong, Dr. W. J. Humphreys, meteorological physicist of the U. S. Weather Bureau, said in commenting on the recent fog dispersing tests at McCook Field.

Rain occurs because many very small particles of moisture that form the cloud or fog are brought together to make big drops that have sufficient weight to fall to earth. In a cloud there is usually a superfluity of dust particles. Each little fog particle has one or more dust particles all its own.

Rain formation begins by rising moist air expanding and becoming cooler as it reaches the upper levels of the atmosphere. The first portion of the rising air forms a cloud by condensation of its moisture. Then when the ascending air hits this cloud, many of its dust particles are strained out by the lower layers of the cloud. And as it cools by further rising the air that was warm can not hold all the moisture that it carries. More of it condenses out, and each

newly formed droplet goes in search of something to cling to. Some of them find unsurrounded dust particles, but many more find the dust they covet already occupied by a droplet of water that is still light enough to fall very slowly. In fact, every particle that makes up a cloud is always slowly falling. When the new water joins with that already there, the combination becomes heavy and the drop of rain plunges downward to earth, often carrying with it other smaller drops. Below, the people say: "It is raining."

The scattering of plain dust or finely powdered material in the upper air to serve as nuclei for the raindrops was declared by Dr. Humphreys to be absolutely absurd in view of the way in which rain forms.

But the scattering of electrified sand for the dispelling of small strips of fog, such as has been done at McCook Field, he believed might prove of value in military operations where expense is no consideration.

Any electrified object might attract to itself minute particles of moisture in a fog and carry them down with it. This clearing of the air would take place only in the area in which the sand or other electrified objects were falling. Such a method could not be carried out on a large enough scale to produce an appreciable amount of rain.

GERMS CAUSING TEETH DECAY

Science Service

BACTERIA capable of causing tooth decay or dental caries have been discovered and isolated here at the U. S. Army Medical School by Dr. F. E. Rodriguez, captain, dental corps.

This accomplishment is declared to be the greatest step toward getting at the real bacterium of dental caries that has been taken in the last three decades since the American dentist, Miller, established the assumption of the German bacteriologist, Koch, that tooth decay is caused in some way by bacteria.

Dr. Rodriguez told in an exclusive Science Service interview how he isolated three types of bacteria with an exceedingly high acid-producing power, capable of dissolving the hard lime of the tooth and migrating into the deep tissue. He subjected teeth to pure cultures of these organisms and these teeth developed spots similar in all respects to the usual decay of teeth. Through accurate microscopic work he demonstrated that these same bacteria penetrate into the deep layers of the teeth, and he found these particular types of bacteria far beneath the softened discolored decayed portion.

"Dental decay is essentially a disease of youth and nine tenths of our school children are afflicted," said Dr. Rodriguez, in discussing the seriousness of the dental decay problem. "The effects of dental decay are permanent throughout life."

In addition to experimenting with the tooth decay bacteria, Dr. Rodriguez placed teeth in pure cultures of other bacteria of the mouth and found that these were unable to produce decayed areas.

The three forms of tooth decay bacteria are different morphologically, he found, but their physiological activities appear to be similar. Dr. Rodriguez believes that it may be that only one is the real aggressor. The name of *Lactobacillus odontolyticus*, types 1, 2 and 3, has been given to these germs. The mouth condition under which these troublesome bacteria operate does not need to be acid for these germs can concentrate the acid they produce in restricted spots on the teeth and cause the destruction.

"Modern civilized diet is, no doubt, a contributing factor of dental decay as it leaves much starch and sugar in the mouth capable of being fermented by the bacteria," said Dr. Rodriguez. "Modern diet lacks savory and acid constituents sufficient to stimulate a copious flow of saliva of the proper character. But the bacteria are the real cause and their growth is favored by the mouth conditions of modern civilized peoples.

"Tooth decay or dental caries is one of the most common of human diseases which has so far evaded inquiry as to its specific exciting cause. Since the time of Koch, it has been assumed that tooth decay was caused in some way by bacteria. Dr. W. D. Miller, an American who became a professor in the University of Berlin, worked with Koch and by a series of brilliant researches firmly established what is known as the chemico-bacterial theory of the cause of decay. In short, this hypothesis is that bacteria, of which there are an immense number of species in the mouth, through their life processes ferment acids on the tooth surfaces from starch and sugar food left in the mouth. The acid decalcifies or dissolves the hard ingredients of the teeth, opening passageways into the deeper parts of the teeth through which the bacteria pass and finally cause a dissolution of the hard parts of the teeth. Miller demonstrated bacteria in the fine channels in the dental tissues. Miller was unable, however, to isolate the specific bacterium which was the real aggressor and initial destroyer of the dental tissue. Since Miller's work, 1880 to 1890, it has been assumed that many species of mouth

bacteria which were capable of elaborating acid caused decay.''

Dr. Rodriguez said that further work in identification of the newly discovered bacteria will be carried on and that great possibilities for caries control exist when several suggestive factors that this investigation has developed are worked out.

Concurrently with the work at the Army Medical School on the bacteriology of dental caries, similar work by a group of British scientists was carried on in the Bland-Sutton Institute of Pathology in London. This work has been reported by Dr. James McIntosh and co-workers in the British press. Identical results were obtained in some respects and similar conclusions arrived at.

LIGNITE FUEL

Science Service

LIGNITE char for household or industrial fuel can be made at much lower cost than heretofore, according to results obtained by state and government workers. Engineers believe that this is welcome news, especially to those who live in the Dakotas, Montana, Texas or the other states underlaid by extensive lignite deposits.

Previous workers have generally tried to make gas, tar and other by-products as well as the solid coke or charcoal residue. But W. W. Odell, of the U. S. Bureau of Mines, now reports on tests made in cooperation with the University of North Dakota in an effort simply to make this solid fuel at low cost, without the extra expenses involved in recovery of gas and tar. The results he gives were obtained with a lignite carbonizer which is cheap to build and to operate. With such apparatus Odell makes the char at approximately $1.25 per ton cheaper than was possible with earlier forms of apparatus.

The raw lignite is twenty-five to thirty per cent. water and about five to fifteen per cent. of ash, so that it has a heating value of only 6,000 to 7,500 British thermal units per pound, or about half that of high-grade coal. But when coked in the new type furnaces it gives forty to forty-five per cent. of its weight in a char of 10,000 heat units per pound that is suitable either for making fuel briquets or for use direct as a fuel.

Mr. Odell states that the char itself is ''a splendid free-burning fuel,'' but that it has to be burned in stoves or heaters the grates of which will handle a fine fuel. The bureau engineers and chemists have built some special stoves and heaters which satisfactorily burn the fine material. However, they expect much more general use of the product in briquets.

The estimates are that a successful plant to make one hundred tons of briquets per day would cost $130,000. About three fourths of the investment would be for the briqueting machinery and its accessories and only one fourth for the carbonizing plant. Under these conditions the char or fine material would cost $4.85 per ton and briquets ready to market $8.17 per ton. These prices in lignite regions compare with anthracite quotations of $18 to $20 per ton.

THE PSYCHOLOGY OF STREET LIGHTS

Science Service

ORNAMENTAL street lights now used in many American cities waste two thirds of their illumination upward into space, cause eye injuries, and make motor traffic more dangerous, it was asserted by members of the local branch of the Psychological Corporation at a recent meeting in Washington. Participating in the discussion were Dr. Raymond Dodge, chairman of the division of psychology of the National Research Council, Dr. Shepherd I. Franz, director of laboratories of the Government Hospital of the Insane, and Colonel R. M. Yerkes, commanding officer of the division of psychology in the Office of the Surgeon General during the world war.

Methods were suggested by which at the same cost twice the present amount of light could be delivered to the sidewalk and roadway and traffic dangers decreased. Lighting for use rather than ornament was advocated.

Street light is useless unless it falls on terrestrial objects, it was pointed out. Light that radiates upward into space might make a pretty sight from Mars, if the inhabitants of that planet could see it, but it is useless for street illumination. Most of the light from the white street-lamp globes goes off into empty space or lights the fronts of buildings. Only about one third serves to illuminate the sidewalk and streets.

At the same cost, it was declared, illumination of streets could be made twice as effective. Although full salvage of the lost light would be impossible without disfiguring or abandoning the present pretty white globes, something would be accomplished by placing a horizontal reflector on the bulbs. It would be still better, it was emphasized, to replace the globes by scientifically designed reflectors which would form a hood over the lamp and concentrate the light downward where it is of use.

Instead of seeing a lot of pretty lamps as one looked down the street, cats, dogs and people, automobiles and the road, would stand out strongly. The difference would be much the same as the difference in the appearance to a driver of the road when illuminated by his own head lights

as compared with the way it looks under the illumination of an oncoming automobile.

The glare of the bright spots of light, such as that made by the white globe lamps, decreases the visibility of near-by objects. This is exemplified in the familiar and sometimes disastrous effect of oncoming automobile headlights.

Lights, provided with reflectors to direct the illumination toward the earth and shield the eyes of motorists and pedestrians from glare, should be numerous enough to prevent deep shadows and avoid the flicker caused by sharp alternations between light and dark. Nature has provided the eye with a compensating mechanism by which it may adapt itself to partial darkness and still see very well. But this mechanism acts slowly and rapid alternations of dark and light is trying on the eyes and disturbs vision whether in the movies or on the street.

"Street lighting must be based on common sense, but no good common sense ignores scientific facts. Modern street illumination makes a pretty effect, but it is inefficient in these days of congested fast traffic and high taxes. It would pay any city to have its lighting arrangements planned by a specialist, an illuminating engineer in consultation with artists and the local lighting companies."

NEW USES FOR COPPER BY-PRODUCTS

Science Service

COPPER refineries in this country are in a position to produce much more tellurium and selenium if there is a demand for these unfamiliar elements, Dr. Victor Lenher, professor of chemistry of the University of Wisconsin, told the American Institute of Mining and Metallurgical Engineers on February 21. He pointed out many possible uses to which these substances could be put.

Selenium is chemically similar to sulfur and experiments already made indicate that it might be used instead of sulfur in dyestuffs and in the vulcanization of rubber. The principal uses of selenium, at present, are in the manufacture of ruby glass and as a decolorizer of white glass. Crystalline selenium is an electrical insulator in the dark, but when exposed to light it becomes a conductor, the conductivity being proportional to the intensity of light. This property has led to its use in many ingenious mechanical devices, including machines for sending pictures by radio, self-lighting buoys as sea-coast safeguards, and an apparatus to enable blind people to read ordinary type by ear.

Tellurium, now used as a crystal detector in wireless receivers, as a blue, brown and red coloring agent for glass and porcelain, and for toning photographic prints, could probably, he suggested, be employed in electrolytic plating. One of the compounds of tellurium will prevent knocking when added in small amount to heavy gasoline, but he said that it is not abundant or cheap enough for general use in automobiles and a specially designed engine is required.

ITEMS

Science Service

SCORES of radio stations have been set up in the Belgian Congo where in the past savage drum signals alone were heard.

GASES pass through solid, heat-resisting quartz glass when heated to 300 to 900 degrees Centigrade faster than they could flow through small holes in the glass, J. B. Johnson and R. C. Burt, of the engineering department of the Western Electric Company, have determined. The transfusion begins at the temperature at which structural changes are known to occur in crystalline silica and suggests that the passage of gas may accompany a change in the structure of the noncrystalline material. The gases used were nitrogen, hydrogen and the rare gas, argon.

ANDRODEDOTOXIN, the poisonous principle contained in the leaves of the rhododendron, has been studied pharmacologically by Dr. S. W. Hardikar, of the University of Edinburgh. This substance when administered in large doses causes death by paralysis of the heart muscle, while in smaller amounts its fatal action is due to the failure of breathing through its action on the nerves to the muscles of the chest which are concerned in the act of breathing. A few years ago it was noticed that sheep in the neighborhood of Edinburgh showed toxic symptoms after eating rhododendron leaves, with fatal results in some cases. Interest in such observations led Dr. Hardiker to study the poisonous substance which these leaves contained.

INTRODUCTION of a new alloy used for one of the electrodes in the electrolytic refining of copper has cut the cost of copper production at Chuquicamata, Chile, to only 6.4 cents per pound, according to the annual report of the Anaconda Copper Mining Company. The new alloy consisting essentially of copper and silicon, developed by C. G. Fink, is used for the anode during copper recovery from the electrolyte and reduces current losses and contamination of the product experienced when ferrosilicon and lead electrodes are used. Figures of the Chile Copper Company show that the cost per pound of copper exclusive of interest depreciation and depletion dropped from 10.8 cents in 1921 to an average of 6.4 cents in 1922. In 1915 the figure was 16.34 cents.