

THE SCIENCE NEWS-LETTER

A Weekly Summary of Current Science

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MAN-MADE LIGHTNING STUDIED TO FOIL NATURE

Two million volt artificial lightning is being created in the research laboratories of the General Electric Company at Pittsfield, Mass., in order that buildings and high power electrical transmission lines may be protected against the powerful "electrical dynamite" that nature discharges during storms.

F. W. Peek, Jr., engineer in charge of the spectacular experiments now in progress, explained that in addition to the trouble that engineers have in keeping power current from escaping from the conductors, there is the very important problem of lightning protection. A few million horsepower are released in a fraction of a millionth of a second when the lightning crashes. Electrical engineers must know how to prevent this destructive force from reaching the conductors of power lines or they must arrange so that it will discharge harmlessly to the ground when it does get to the line.

In 1916 when the General Electric engineers built their first lightning generator it produced only 200,000 volts but now 2,000,000 volts flashes with all the characteristics of real lightning are generated at will. Wooden posts of large size are readily shattered and blown apart.

A model village for the study of lightning protection has been built in the laboratories and with controlled lightning the best methods of protecting power plants, churches and other buildings are being worked out, Mr. Peek said.

The highest voltage actually used at the present time for the commercial transmission of power is 220,000 volts on a line in California, but the General Electric Company has an experimental million volt line. Mr. Peek declared that it is too early to say whether such high voltages will ever be required in practice. But, he said:

"A single 220,000-volt transmission line in a year can transport for 300 miles energy equivalent to 1,000,000 tons of coal, while a 1,000,000 volt line could transport for 1,000 miles energy equivalent to 25,000,000 tons of coal."

READING REFERENCE - Outline of Science, New York, G. P. Putnam's Sons, 1922.
Chap. VIII, pp 199 - 205; Chap. XXIV, pp 553 - 575. Flammarion, Camille.
Thunder and Lightning. Boston, Little, Brown and Company, 1906.

NEW DISEASE WIDELY REPORTED IN U.S.

A new disease of man, called tularemia, has been found to be present over the whole of the United States and infections in human beings have been found from the Atlantic to the Pacific coast, a report by the U. S. Public Health Service has revealed.

Investigators from the U. S. Hygienic Laboratory here discovered that rabbits being offered for sale in the Washington market this winter were in some cases infected with this disease, never known in the East before outside the laboratory. It has been epidemic in some western states, particularly Utah, for about five years. Tests showed that one market man was immune to the disease because of a severe attack last year. Cases were also reported from Cincinnati, Ohio, and Charlotte, N. C. Additional cases of infection are to be expected, the experts predict.

Since the government laboratory started to study the disease, which was first discovered as a fatal epidemic among ground-squirrels in California, six scientific workers have contracted the malady, one of them twice. Among the victims was Dr. Edward Francis, in charge of the investigations. The attacks being with a high fever lasting about three weeks and are followed by about two months of convalescence. Although the disease has few fatalities, it causes a long period of illness that works a particular hardship on Utah farmers since it usually occurs there in midsummer.

A germ, known as *Bacterium tularense*, causes the disease and it is transmitted by the blood-sucking fly, the stable fly, the bedbug, the squirrel flea, the rabbit louse, and the mouse louse, only the first four of which bite man. The germ can also gain access to the human blood stream through broken skin while an infected rabbit or squirrel is being handled.

READING REFERENCE - Libby, Walter. The History of Medicine in its Salient Features. Boston and New York. Houghton Mifflin Company, 1922.

ESKIMO THOUGHTS AND BELIEFS

UNTOUCHED BY WHITE INVASION

By Knud Rasmussen,
Leader, Danish Arctic Expedition,
Now in Far North.

(This article was written in the Arctic at Lyon Inlet north of Hudson Bay.)

Through the white man's influence on the material culture of the Eskimos they have in many ways become far removed from the original Eskimo characteristics. Luckily for the ethnographic researches of this expedition this has not been wholly the case with their spiritual culture. With a few exceptions they are utterly uninfluenced and still live entirely in the traditions of their ancestors. This is a natural consequence of the fact that the white men who

settled among them had exclusively commercial interests and did not care to influence them otherwise. To be sure, there is a Catholic mission in Chesterfield, but the baptized community up to now consists only of two or three families. When the result is no greater than as in this place, the reason must lie in the difficulties connected with proselyting among people who live so scattered and form such small communities in regions so difficult of access.

The reindeer hunting which is the principal trade demands a wandering life, and as it happens, the few christian families living at Chesterfield are entirely kept by the mission. The interests of the merchants agree very well with the claims of the trades on the natives who can only carry on fox-hunting on a large scale by not being stationary, and consequently, the business done here has not brought about alterations in the habits and journeys of the hunters. The few families who live in the neighborhood of the very trading-places, which lie at a distance of about 400 to 600 miles from each other, are permanently engaged and well paid for their work. Regardless of whether the man is single or has a family; his wages are twenty-five dollars, paid monthly, and full board consisting in weekly rations of flour, baking-powder, fats, tea, sugar, mollasses or jam, etc. This standard pay is in itself not particularly high on the part of the companies themselves, because everything sold from the stores has correspondingly high prices, but on the other hand it makes it rather expensive for strangers who have to take natives into their service or who want to buy ethnographical specimens from them. In many cases this has been brought home to the expedition.

Believe In Fate

People here have the well-known Eskimo qualities and are kind-hearted, always smiling and helpful, but on the other hand, like so many of their tribesmen elsewhere, they are not very energetic. They lack initiative and let the days come and go with good and bad events while resting content with the thought that all that will happen must happen. They are gay and amusing when they visit our station but rather troublesome for they build their snowhuts beside our house, being of the opinion that it is our duty to sustain them. This is, however, to some extent due to the fact that, contrary to the other white men of the country, we do not want to trade with them, and when we do not want to buy their fox-skins they think that all our possessions ought to be at their disposal. This does not make them less troublesome, and we have therefore seldom had guests but that we have had to request them to leave when we had learned everything from them which was of interest to us. This never surprises them and we preserve our good relations to them. But as we are over here to study them through personal contact we must in various ways seek their company. For example, Bangsted and Birket-Smith, two members of the expedition, for a long time led a completely "native" existence among the Padlermiut Eskimos as the "adopted" sons each of one family, eating off the same dish as their hosts, sleeping in their tents, partaking of their singing feasts and wizardry, and thus getting a unique insight into their intimate life and habits. On one occasion it was, as a matter of fact, they themselves who were the cause of the conjuring in that the adopted father of Birket-Smith, himself a great angakoq, had got the idea that they were threatened by danger. In order to avert this danger neither of them should ever afterwards be permitted to wear the footgear they wore at their arrival in Hikuligjuaq, but to keep them, and after their return to the white man's country their mothers were in the future to go about with their boots sown

on the backs of their dresses. And as the Eskimo was not sure that they had understood him correctly, the spirits were so generous as to give them an indulgence, until it could be interpreted to them in the right manner.

The Eskimos are always very greedy for white man's grub, and as the essential condition for all our work is to be on a good footing with the population, we are often obliged to travel with unproportionally great supplies if we do not wish to be half starved together with those whom we visit. This can be done on long journeys when the natives realize we can not carry much, but it is neither understood nor forgiven in our own district where they know that we have our good supplies. Nor does the fact that we cannot count on getting any dogs' food contribute towards making our travelling conditions easier, and we frequently think, with a certain wistfulness, of the many times in Greenland when dog's food for the guests was a matter of course. All these things, which merely sound like trivialities, I have, however, not wanted to suppress in this account because in the daily life up here they are serious facts, which we are obliged to reckon with.

Dr. Edwin E. Slosson

CHATS ON SCIENCE

A SELF-GOVERNING TURBINE

The wealth of Sweden lies largely in its waterpower. This amounts to about one and a fifth horsepower per capita, according to the calculations of Dr. Arrhenius, head of the Nobel Institute. Even the United States is not so rich in hydraulic resources in proportion to its population and is not yet making as much use of what it has.

The Swedes have broken to harness one quarter of their wild waterfalls and are preparing harness for those that are still running at large. They are not afraid of a coal famine for they have always had one. From their wood and waterfalls they can get both heat and power, and they are making every effort to be as independent as possible of those countries which have inherited their wealth from the Carboniferous Epoch.

I never realized how many Swedes had wheels in their heads till I entered the Machinery Hall of the Gothenburg Jubilee Exhibition where their new inventions are displayed. There were turbines on every side and overhead. Turbines for water; turbines for steam; turbines for milk. Turbines three times as tall as I was and turbines that I could hold in my hand. It seemed that the spirit of De Laval had inspired the nation.

Among these various turbines were some of novel and curious form. One I took for a ship's propeller, instead of a water wheel, for it had only three blades and no rim. On inquiry I found it was called the Kaplan turbine and was just being developed in Sweden.

In order to secure the greatest efficiency as a power producer a turbine has to be constructed so as to run at a certain speed under a given head of water. But when the load, speed, flow or pressure changes, the turbine does not work so well as one of a different design would. To overcome this difficulty Professor Kaplan of Brunn has invented a waterwheel with adjustable blades and guide vanes which are automatically shifted to a different angle by a sensitive governor so as to secure the greatest possible efficiency whenever the conditions change. In this turbine the blades are reduced to four or three or two and are made short and broad, being so set as to pass the water through in a continuous positive eddy without reverse currents anywhere.

A turbine of the Kaplan type is now being constructed by the Kristinehamn works for the Royal Swedish Waterfall Board to be installed at Lilla Edet. In this a single wheel of 19 feet diameter, weighing 62 tons, will give 10,000 horse-power under a head of 22 feet, and can take an overload of twelve per cent. Its specific speed is 640.

The specific speed is the number of revolutions per minute that a single turbine would make if of such a size as to give one horse-power under a unit head of water, which in the European system is one meter. The higher the speed the less the efficiency as a rule, but it is claimed for the Kaplan turbine that it will show an efficiency of more than eighty per cent. with a specific speed of over 800 a considerable gain over the speeds of 300 or 400 formerly customary. A recent installation of a Kaplan turbine shows an efficiency ranging from 84 to 86 per cent. with the horse-power varying from 57 to 99, and a specific speed of 718, the highest yet attained in Scandinavia. The conical construction of the outlet pipe, whether straight or bent, produces a suction below the wheel that adds to its power.

But its self-governing ability was what interested me most. If I slowed up the wheel of the model by the touch of my hand it adapted itself to the new condition as quickly as a gyroscope top when it is tipped. It was indeed a model - to human beings who often wobble and creak badly when their equilibrium is disturbed and waste much time and energy before adjusting themselves to changed conditions of load or motive power.

READING REFERENCE - Gilbert, Chester G. and Pogue, Joseph E. America's Power Resources; The Economic Significance of Coal, Oil, and Water Power. New York. Century Company, 1921. Fergusson, Frank F. The Fundamental Principles of Water Power Engineering; describing types, applications and operation of water turbines and developing fundamental formulae of water power engineering. New York. Sir I. Pitman and Sons, 1921.

Of all occupied men and boys in 23 leading countries, 51.4 per cent. are engaged in agriculture, and, of all occupied women and girls, 60.6 per cent. follow agricultural pursuits.

NEWS OF THE STARS

By Isabel M. Lewis,
U. S. Naval Observatory.

MEASURES HEAT OF PLANETS AND MOON

By the same method that has been so successful in measuring the heat of the stars, absorption of the infra-red or heat rays by a water-cell and measurement of the radiation transmitted by means of a vacuum thermocouple, Dr. W. W. Coblentz of the Bureau of Standards has obtained some valuable measurements of the heat radiations of the planets and the moon. The measurements were made at the Lowell Observatory with the aid of the 40-inch reflector. The planets with the densest atmospheres, it was found, had the least radiations of the heat rays which result either from the warming of the planet's surface by the sun's rays or from the emission of internal heat. This was believed to be due to the fact that a dense atmosphere acts as a screen in keeping the surface radiations in and, to some extent, the solar radiations out.

In the case of Jupiter the heat radiations were found to be zero showing that no internal planetary heat, if such exists, penetrates to outer space and that none of the sun's rays, even if they reach the surface or lower atmosphere of the planet and are effective in warming it, are able to return to outer space through the dense atmosphere. All radiation from the planet Jupiter is that of reflected sunlight.

In the case of Saturn, which also has a dense atmosphere, it was found, however, that fifteen per cent. of the total radiation is heat radiation from the surface of the planet or its atmosphere. Since spectroscopic observations show that the atmospheres of Jupiter and Saturn are similar in composition, either the atmosphere of Saturn is less dense than that of Jupiter and so less effective in trapping the sun's rays or else Saturn possesses considerable internal heat which is being radiated to outer space.

So effective is the atmosphere of Venus in trapping radiations from its surface that only five per cent. of the total radiation from the planet is radiation of heat rays from the surface or lower atmosphere, in spite of the fact that Venus is so much nearer than the earth to the sun that twice the amount of solar radiation reaches its outer atmosphere and should be available for heating its atmosphere and surface.

In the case of the moon eighty per cent. of the radiations were found to be heat radiations. This remarkably high percentage arises from the fact that there is very little, if any, atmosphere so that practically all of the solar radiation reaches the surface which becomes highly heated and reradiates its acquired energy directly into space in the form of heat rays. The remaining twenty per cent. is directly reflected sunlight.

For Mars thirty per cent. of the radiations were found to be infra-red or heat rays indicating that the atmosphere is rare and that the surface is highly heated by the sun's rays. The measurements also showed that the southern hemi-

phere, at the time of the observations, was emitting more heat rays than the northern hemisphere. As the winter season with its increased cloudiness was approaching in the northern Martian hemisphere, lower heat radiations were to be expected both because the surface was becoming cooler and because there were more clouds and mists present to trap the outgoing radiations.

The radiation measurements obtained for Mars by Dr. Coblentz support the high-values obtained by Prof. Percival Lowell for the mean surface temperature of Mars, 48 degrees F. to 72 degrees F. The daily range of temperature on Mars is very high, possibly from below freezing at night to 70 degrees F. at midday according to reliable estimates.

READING REFERENCE - Lewis, Isabel M. Astronomy for Young Folks. New York. Duffield and Company, 1922. Campbell, W. W. The Daily Influences of Astronomy. In Annual Report of the Smithsonian Institution 1921. Washington, Government Printing Office, 1922.

DISCOVERS FIRE-SWEPT CITY OF ANCIENT MAN IN TENNESSEE

Charred and blackened remains of a beautiful prehistoric Indian city, destroyed by fire long before the advent of the white man, but formerly covering an area of 500 acres and defended by a palisaded wall and breastworks more than a mile in length, have been discovered in two bends of the Harpeth River near Kingston Springs, Tennessee, by W. E. Myer, special archaeologist of the Smithsonian Institution.

Mr. Myer, who recently returned to Washington after two and a half months excavation at this ancient site, declared that no other old Indian town in the United States was laid out with such artistic skill as is evidenced in the structural plan of the great mounds of this large fortified place.

On one bend of the river is a great hill which was artificially shaped by the ancient builders from bottom to top. Three wide terraces were built at various levels along this hill, and its original summit was cut away until a level plaza, about 1,000 feet in length and 500 in breadth, had been formed. On this level plaza they had erected a large mound. Around the edge of the plaza and the terraces other mounds had been formed. The sun-baked clay used in the construction of ancient earth lodges was found surrounding the open plaza and along the terraces.

In addition to this great central mound on the bold terraced hill, which formed the most striking feature of the city, there were within the walls five other eminences which had also been leveled into plazas. These yielded many traces of the ancient earth lodges and other evidences of the former inhabitants. The remains of about thirty mounds of various sizes have been found. On the edge of the terraces were the earth lodges of the common people. The sacred temples and council houses and the earth lodges of the chiefs and subchiefs had probably been placed on the summits of ten of the largest mounds.

The upstream portion of the ancient city was defended on the water side by perpendicular cliffs of the Harpeth river. On the land side, Mr. Myer said, many traces still remain of the ancient breastworks, which extended for about a mile and a half and originally had wooden palisades about 10 feet in length firmly embedded in their tops. These palisades formed a wooden wall which had been plastered on the outside in order to make scaling difficult by an enemy. Along this wall at intervals of about 150 yards were found earth bastions which had formerly supported semi-circular wooden towers. The enemy advancing to an attack was therefore subjected to fire from the defenders along the main wall and also an enfilading fire from the warriors in the towers on these bastions. Faint traces of the wooden towers and of the wooden palisades were found. The great length of the wall to be defended indicates that the city must have contained several thousand inhabitants.

All the buildings whose traces were uncovered appeared to have been burned. Under an overturned wall the charred remains of the woven-reed tapestry which had formerly hung on the walls of the building were discovered, and Mr. Myer and his assistants secured plaster casts of this ancient work of art for the Smithsonian Institution. No object of white man's manufacture was found on the site. Everything denoted great age.

"Beyond all question," Mr. Myer declared, "this town had been lived in and destroyed long before the coming of the whites into the region, while the Indians which claimed this section of Tennessee stated to the first whites that their Indian forefathers had found these remains lying silent and deserted when they arrived."

The mention of these mysterious mounds in a rare book long since out of print gave Mr. Myer the clue which led to the exploration of the place. An airplane was used to survey and photograph the ancient Indian town site.

ALCOHOL FROM SUGAR RUNS HAWAIIAN PLANTATIONS

Gasoline shortage holds no terrors for the Hawaiian Islands. Their chief crop, sugar cane, is not only able to supply all the motor fuel needed locally, but also enough surplus to make a worth while export, should the price of gasoline rise much above its present level.

The manufacture of industrial alcohol from molasses is merely awaiting the demand, according to an extensive report issued by H. P. Agée, director of the experiment station of the Hawaiian Sugar Planters' Association, and W. L. McCleery, assistant sugar technologist of the same institution.

Technical problems, they say, have been solved in a satisfactory way with respect to manufacturing both motor alcohol and stove alcohol for domestic fuel purposes. But at the average prices of gasoline and kerosene for the last five years, extensive production is not an inviting proposition.

One sugar plantation, the Maui Agricultural Company, now has in operation an industrial alcohol distillery which is supplying the needs of 32 trucks, 20 passenger cars and two tractors owned by the plantation and its employees. Five hundred stoves used in the kitchens of the field laborers are also being supplied with fuel from this distillery.

Difficulties incident to the substitution of motor alcohol for gasoline in automobiles are said to have been overcome. Much experimentation was necessary in arriving at the present satisfactory formula but now there is essentially no difference between motor alcohol and gasoline in facility of starting or general ease of operation. The life of the motor and extent of repairs is not influenced by the new fuel. Automobiles at the Maui plantation, which have been operated with alcohol for several years, have less carbon trouble than when they used gasoline. Proper carburetor adjustment must be made in changing the fuels, however, as not all carburetors are suitable for alcohol.

Alcohol possesses certain advantages over kerosene as a kitchen fuel. It burns with a clean flame, without smoke or soot. In point of fire risk, it is more inflammable, but more readily extinguished by water. A greater volume of alcohol is required, except in so far as sooty utensils reduce the efficiency of kerosene.

Agee and McCleery estimate that it would cost, independent of the value of molasses as a raw material, about 8 to 11 cents to produce a gallon of industrial alcohol. Molasses at present is a waste by-product of the sugar cane industry. It is used somewhat as fertilizer and somewhat as stock feed, but is practically valueless. Stove alcohol costs about 25 per cent. less to make than motor alcohol. Ether as well as the alcohol can be made from the molasses.

READING REFERENCE - Slosson, E. E. Creative Chemistry. New York. Century Company, 1920.

MAP MAKERS TO SHOOT COLORADO RAPIDS

Col. C. H. Birdseye, chief topographical engineer of the U. S. Geological Survey and World War veteran, left Washington recently on one of the most adventurous explorations ever undertaken by the government in peace time - a survey of the deep, narrow gorges of the Marble and Grand canons of the Colorado river, the most dangerous and treacherous in the world.

He will be in charge of a party of ten mapmakers, geologists, and boatmen, who will go down the most dangerous section of the river in specially constructed boats. These will be fitted with air chambers. The men are strapped in a little cockpit in the center of these craft, wearing life preservers at all times and provided with long life ropes.

The distance to be explored covers about 300 miles through northern Arizona.

The mapping of the Colorado has been in progress since 1909 but the dangerous part has been left for the last. When the party returns this fall they will have completed records of the slope and topography of the entire stretch of river - an aggregate of about 1200 miles on the Colorado and Green Rivers and several hundred miles of the principal tributaries.

Four of the specially constructed boats will be used, manned by the most skillful boatmen to be obtained in that section, all experienced in shooting rapids.

The rapids in this section of the river form some of the wildest water in the United States and each member of the party has been selected for his fearlessness in the face of danger as well as for his ability as scientist.

Part of the work will consist of locating available dam sites in view of the proposed commercialization of the Colorado.

READING REFERENCE - Dellenbaugh, Frederick Samuel. The Romance of the Colorado River, with an account of the later explorations. New York, G. P. Putnam's Sons, 1909.

READS NEWSPAPER BY LIGHT OF COSTA RICAN FIREFLY

Beetles which emit almost continuously a light so brilliant that one or two imprisoned within an inverted tumbler will illuminate a moderate sized room sufficiently to make print readable are among the wonders found in the Costa Rican wilds by Robert Ridgway, ornithologist of the U. S. National Museum, and included in an account of his explorations recently published by the Smithsonian Institution.

The display sometimes made by thousands of our "lightning bugs" or fireflies over damp meadows of a warm summer night, he says, is only a feeble imitation of the splendid pyrotechnic display made by thousands of these large Costa Rica beetles, called Carbuncles, pronounced "carbunclys". The light of the carbuncle is not intermittent like that of our fire-flies, but is nearly continuous and differs in color in different individuals. The lights are most often yellow, but sometimes green or occasionally ruby red.

Prof. Ridgway also tells of the Costa Rican Bell Bird, about the size of a pigeon, the call of which sounds like the whack of an axe against a hollow log and can be heard for more than a mile.

Costa Rican robins, house wrens, and yellow warblers have a much finer song than their close kin in North America, he found.

Reindeer herds started in Alaska thirty-three years ago with sixteen animals have grown until today there are 250,000 head of reindeer in that territory.

A new sweet cherry which ripens from a week to ten days earlier than any cherry now grown has been evolved at the New York Agricultural Experiment Station.

American phonographs are very popular in Indian huts in Yucatan.
