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FREE AIR

By Dr. Edwin E. Slosson.

Wind was the first machanical motive power that man learned to use. Probably it was discovered by some savage of a long gone age who made a sail of his blanket and a mast of himself, like Fayaway in Melville's "Typee", and so found his canoe propelled across the lake without the labor of rowing. From this simple craft was descended the skiff, the schooner and the full rigged ship.

A few hundred years ago someone, perhaps a Dutchman, discovered that it was possible to attach the sails to a stationary post, instead of to a movable mast, and so make a windmill that would grind his corn. In England a windmill is mentioned as early as 1191. In France we can go back to a date of 1346, for we are told that Edward III viewed the battle of Cressy from a windmill.

But when the more convenient and reliable coal came in the local windmill and waterwheel went out, and the steamship replaced the sailboat. At the present time, little use is made of wind power, either on sea or land, although "free air" is to be had anywhere. But I venture to predict that sometime in the future - a wise prophet is indefinite as to dat - the inexhaustible reservoir of kinetic energy in the moving atmosphere will be drawn upon for motive power to supplement or replace our stores of fossil fuel, now being rapidly exhausted.

I imagine that sails will once again be seen upon the sea, more frequently than they ever have been before, and that landlubbers too will eventually find that they cannot afford to neglect this freely flowing energy. It amounts to considerable if you figure it out. Suppose for instance that you live in one of those states where the velocity of the wind averages roughly 11 miles an hour throughout the year. This velocity of air represents about one-tenth of ahorse power per square meter at right angles to the wind. A layer of this wind, 66 feet deep and 425 miles from side to side, would represent 1,368,000 horse power.

I do not wish, however, to be understood as saying that a farmer could put up a row of windmills and extract all the energy from the passing breeze. This would, of course, mean stopping the wind entirely, and would result in an uncomfortable accumulation of dead air on the farm, that would be difficult to dispose of, and his neighbor next beyond would not be able to raise the wind.

But it does seem to me that we might well utilize even now a little more than we do of this vagrant wealth. It is purely a practical problem of collecting and storing and delivering scattered and variable quantities of energy, the same

problem as we will have to solve if we are to utilize the wasted power of our mino streams and fluctuating tides.

At present the most practical way of storing wind power is by employing it to pump up water into a tank so as to use the gravitational force of its fall when wanted. But this method is of limited application. A more promising scheme is to use the surplus wind power in charging a storage battery, from which electrical currents can be drawn as needed. But on account of the expense and difficulty of keeping up an extensive storage battery system this has not yet come into common use, although there are several practical wind-electric outfits now being manufactured in this country. Another and more ambitious plan of solvine the problem is proposed by J. B.S. Haldane of Cambridge, who has the most far-reaching imaginatio of any biologist since Wells grew up. In his new book, "Daedalus" he foresees the time when England will be covered with rows of metallic windmills running dynamos. The surplus power of these will be used for decomposing water into hydrogen and oxygen, which will be liquefied and stored underground in great jacketed reservoirs. In times of calm the two gases will be again combined and since they produce the most heat of any chemical reaction, they would be used in gas engines. But even Mr. Haldane puts this four hundred years in the future.

The modern wind motor is more efficient than the steam engine as an energy transformer since it can utilize some 15 per cent of the power of the wind that reaches it while an ordinary steam engine does not ordinarily utilize more than 13 per cent of the energy of the coal. But the water turbine is far more exonomical than either since it can make available 70 per cent or more of the energy it receives. In experiments made some years ago at the Agricultural Experiment Station of North Dakota it was found that the cost of electricity from a windmill in that state was only about a third of its cost from a gasoline engine, and that the initial expense of the two outfits was practically equal. The Agricultural Experiment Station of Wisconsin found that the wind in that state could be depended upon to blow at the rate of nine miles an hour or more for five thousand hours in the year. This is sufficient to run a windmill, which therefore would be working 14.3 hours a day on the average. A 16-foot geared windmill would furnish two horse-power for ten hours a day. The Germans are experimenting on gigantic wind power plants to replace the coal they lost through the war and it is claimed that these can produce current at a cost of less than a cent per kilo-watt-hour.

It is to be hoped that some day we may be able to get our power from the clean and open air rather than from the dark and dirty mine. A row of revolving vanes on a hilltop is certainly more picturesque than an oil derrick or coal dump. There would also be gain from a sociological as well as from an esthetic standpoint since wind power is to be had almost anywhere and cannot be monopolized like coal and oil. It is a decentralized source of power, and it is inexhaustible.

The transfer of so many art treasures from Europe to America by peaceful methods of purchase is the greatest transaction of its kind that history records.

More than one-half of all the telephones in South America are in Argentina.

DISCOVER HYDROGEN GAS HAS TREMENDOUS BURSTING POWER

Highly compressed hydrogen gas has a tremendous bursting power all out of proportion to its pressure, according to Dr. P. W. Bridgman of Harvard University in a recent report to the American Academy of Arts and Sciences.

A chrome-vanadium-steel cylinder in preliminary tests withstood the enormous pressure of 160 tons per square inch, but succumbed to only 60 tons pressure when hydrogen was doing the work. Hydrogen is the most finely divided form of matter known. Apparently its extremely small molecules squeezed their way amongst the steel particles and demolished their structure.

At these excessive pressures the repulsion of hydrogen molecules of each other becomes stupendous. In Dr. Bridgman's experiments hydrogen even at the highest pressure could not be concentrated into a form as dense as common cork. At 60 tons pressure a quart of the gas weighed only three ounces - a fair rating for a quart of feathers not too well packed. It required over 90 tons pressure to force the molecules together shoulder to shoulder, that is, barely to eliminate the empty space which normally constitutes most of the volume of a common gas.

All known laws of gas pressure familiar to gas engineers break down at the extreme pressures of Dr. Bridgman's experiments. As was anticipated, it was not found possible to liquefy hydrogen by pressure alone, despite the fact that the pressure of 90 tons per square inch was able to pack the gas into half the space that the substance occupies as a solid under conditions of extreme cold.

NON-SCIENTIFIC CALLED BY NEW NAME

Are you a sciosophist? This is a word coined by Dr. David Starr Jordan, and defined by him in his address as retiring president of the Pacific section of the American Association for the Advancement of Science. A sciosophist is a member of the cult of organized ignorance, Dr. Jordan declared, and he placed in the ranks of sciosophy the fundamentalists, the believers in the Divine right of kings or State, militarists, and faith healers of every description.

"The word Sciosophy (shadow-wisdom) was coined by me," said Dr. Jordan, "to meet a long-felt want. It differs from ordinary science in its bases. It is not derived from tested and verified human experience, because life is short and humanity demands quick returns. It recognizes no relation of cause and effect, for these are mere human devices.

"Sciosophy, as history tells us, was the basis of the wisdom of the Middle Ages. The Divine Right of the Chruch, that of the King, and in later times, the Divine Right of the state, rested solidly upon it. They could have no other basis, as the tested results of human experience all point in other directions.

"It has been left for modern times to drag the purity of celestial conceptions into terrestrial mud," continued Dr. Jordan, who paid his respects to the fundamentalists by a reference to the action of what he termed "a group of sciosophists in Columbia, South Carolina, who 'Resolved, that man was created by an instantaneous process without previous animal parentage'".

"This in a single sentence," the scientist declared, "elucidates the origin of

Man. And if necessary, the same truth could be proved by inversion. There is no man in animals, therefore there is no animal in man."

After declaring that various faith healing cults were all manifestations of sciosophy, Dr. Jordan explained them by saying:

"Authority on the one hand, something to lean against, and sympathy on the other, something to cry into, these are the chief demands of humanity in the mass. Both these Sciosophy can furnish in full measure. No instruments of precision are necessary to set up authority or to set free the fountains of the soul, and these once flowing know no limitations of time or space. Esoteric dreams solace the future, absent treatment is better than present medicine. Its defiance of materialism proves its spiritual value.

"Scienceon the other hand, is classified knowledge," said Dr. Jordan, contrasting it with sciosophy. "Its cardinal principle is that we know nothing until we find out.

"The purpose of science is in the main threefold: first, to help humanity by its control of sanitation, conservation, and the use of the forces of nature. This is applied Science. Second, to furnish a sound basis for the conduct of life. This is the art of Ethics, and right living can fall back on no other authority. We cannot trust to religion, for the sentiment of fear, awe, reverence and duty is sadly entangled with superstition. It is for science to combat superstition and to disentangle religion from its meshes.

"The third function of science is to widen the human mind. Its span is the Universe, dealing as well as may be with the infinite great as with the infinite little. We find in it endless change, but every change is orderly. So far as we can see 'nothing endures save the flow of force and the rational intelligence that pervades it.' This intelligence we cannot describe, nor circumscribe. We cannot speak of it in any terms of human experience, and to try to do so shows only the narrowness of our conception."

READING REFERENCE - White, Andrew D. A History of the Warfare of Science With Theology in Christendom. New York, D. Appleton and Company, 1896.

SUN REACHES FARTHEST NORTH AND SUMMER BEGINS

By Isabel M. Lewis
of the U.S. Naval Observatory.

Exactly at noon (Eastern Standard Time) on Staurday, June 21, the sun reached its farthest northern point and summer began. The sun was at that time in the constellation of Gemini, the group containing the bright stars, Castor and Pollux, which was visible low in the western sky after sunset a few weeks before.

The apparent eastward motion of the sun among the stars which carries it in turn into each of the constellations that lie in its path is but a reflection of the actual motion of the earth around the sun. We see the background of stars changing constantly with the different seasons as we make our yearly circuit of

the sun but always the sun appears in Gemini at the beginning of summer, in Virgo at the beginning offall, in Sagittarius at the beginning of winter, and in Pisces at the beginning of spring.

This has not always been so in the past, however, and it will not always be so in the future. A few centuries hence the sun will be in Taurus at the beginning of summer, in Leo at the beginning of fall, in Scorpio at the beginning of winter, and in Aquarius at the beginning of spring. The constellations visible in the different seasons will not be the ones that we see now in these seasons but constellations now preceding them to the west. For the position of the sun at the beginning of each of the seasons is gradually shifting westward.

Some two thousand years ago the Greek astronomer, Hipparchus, noticed this when comparing his observations of the stars with observations of earlier astronomers, but its cause he did not understand. It was left for the immortal Newton to show eighteen centuries later that this westward shift of the seasonal points, or "Precession of the Equinoxes" as it was called, was a direct result of the action of the law of gravitation. Newton found that the sun and moon were exerting an attraction upon the bulging equatorial regions of the earth in such a way as to cause a yearly slipping westward of the plane of the earth's equator along the plane of the earth's orbit and a yearly shift in the position of the earth's axis of rotation. The rate was such that it would cause the axis of the earth to make a complete revolution around the pole of the ecliptic in 25,800 years, while the equinoxes would make a complete circuit of the heavens along the ecliptic in the same period.

Now here is an interesting fact for our "flat-earth" friends to think over. Newton calculated the exact amount of the precession from the law of gravitation and the astronomical theory and he got results that agreed exactly with the observed yearly shift of the equinoxes. But on what were his calculations based? To obtain the results that he did he made use of the following assumptions: That the earth is a spheroid, rotating on its axis in 24 hours, that its distance from the sun is approximately 93 million miles, and that it revolves around the sun in 365¼ days. He also made assumptions as to the massand density of the earth, sun, and moon, as well as their relative distances and sizes. In fact, he made use of all the fundamental assuptions of theoretical astronomy and if these assumptions had not been correct his results would not have agreed with the observations.

READING REFERENCE - Abbot, Charles G. The Sun. New York, D. Appleton and Company. 1911.

LIQUID AIR SUCCESSFUL IN TREATING POISON OAK

Liquid air as a remedy for poison oak troubles is the recent discovery credited to George F. Nelson, technical expert in the Gilman research laboratory of the University of California. Results of the new treatment have proved so remarkable that the university infirmary is now using about twelve gallons of the frigid liquid per month. The Berkeley hills are infested with the notorious western poison-oak (Rhus diversiloba), the bane of numerous lovers of the outdoors. Acting much like its ill-reputed eastern cousin, the poison-ivy, this

plant has always been a great disturber of peaceful student life.

By the new technique a wad of cotton is soaked in liquid air, thereby, being chilled to a temperature of about 300 degrees below zero Fahrenheit. It is now dexterously rolled over a blistered poisoned skin for a time just long enough to freeze a very thin layer, after which the pustules and itching are said to disappear promptly. The treatment seems also to be promising in cases of exzema, and particularly with ringworm.

Years ago federal experts developed satisfactory means of prevention of oak - and ivy-poisoning, but found no cure. The poison is a non-volatile oil which is easily rubbed off from the leaves of the plants upon the skin of the victim. Following its slow absorption an acute irritation is set up just beneath the skin. If a sensitive person is forewarned he may readily eliminate the danger by dissolving the oil in a grain-alcohol wash, to which lead acetate, a chemical obtainable at any drug store, is added. The lead acetate, dissolving in the alcohol, gains direct access to the poison, which it chemically destroys. A final brisk treatment with strong soap and water eliminates all residues.

Liquid carbon dioxide, cheaply obtainable in the ordinary market, was tried at Berkeley in place of liquid air, but so far without success. The temperatures secured with carbon dioxide would hardly attain a value much lower than 100 degrees below zero Fahrenheit. Liquid air at present is not found in ordinary retail trade, and usually is obtainable only on special order at a cost of several dollars per quart. It could be materially cheapened if demand arose for distribution in quantity.

FOURTH MAYAN CODEX REPORTED IN VIENNA

The discovery of a fourth Mayan Codex, or written record of the builders of the great ruined cities of Yucatan, has been reported from Vienna, and Prof. Marshall H. Saville of the Museum of the American Indian left June 26th for Vienna to investigate the reported find. If substantiated it may throw light on the early history of civilization on this continent.

Only three other written Mayan records have been found and they are all hieroglyphs or picture writing. These records, judging from samples that have already been discovered, are all chronological, recording astronomical events, the passing of periods of time, and the coming of festivals and religious gatherings. The reported fourth Codex is said to have been found in a heap of unsorted documents in a museum in Vienna.

SCHOOL FOR EXPLORERS ESTABLISHED IN NEW YORK

In order to produce explorers able to find where they are in a strange country and to accurately locate the finds which they make, the American Geographical Society of New York has established a school for explorers. Specialized training in geographical surveying and field astronomy will be given.

"Exploring and surveying expeditions must obtain the services of surveyors with initiative, practical experience, and all-around knowledge of the subject if they are to take full advantage of the time and money at their disposal," said Dr. Isaiah Bowman, director of the society, in explaining the purpose of the school.

"Such men should be able to make a simple compass traverse or accurate determinations of latitude and longitude with equal ease. They should be skilled in the art of sketching in detail on a plane table or in the execution of a triangulation in all its details, from the initial reconnaisance to the computing of the geographical coordinates of its trigonometrical stations.

"Not only must they be able to do these things, but they must be able to adapt themselves to whatever surrounding they find themselves in, and to choose the surveying methods most suitable to the occasion."

Dr. Hamilton Rice, the distinguished South American explorer, instigated the scheme and is director of the school. The whole course, which is comparable with postgraduate work at a university, should be accomplished in from a year to two years.

Individual instruction, practical work in the field and facilities to handle first class and up to date instruments are features of the instructional methods of the school. Students begin the course at any time and may take all or any part of it.

The practical work in the field includes the mapping of an area of eight or nine hundred square miles on a scale of 1:125,000 or thereabouts. From the initial triangulation reconnaissance to the inking in of the finished map, all must be executed by the student himself. The area selected for mapping is the country on either side of the Hudson river between Dobbs Ferry and Newburgh, and for so small an area affords a great variety in topographical detail.

NEW TYPE OF AIRPLANE CATAPULT PERFECTED FOR NAVY'S SHIPS

A new type of airplane catapult in which a powder charge is used for giving the plane its initial start, instead of compressed air, has recently been tested by the U. S. Navy with satisfactory results.

In the new type, the catapult gun contains a piston which is connected through a series of multiple purchases or pulleys, to a small wheeled car. The car on which the airplane is placed, runs on tracks which are fifty feet long, and are secured to a platform located on the top of a battleship turret. When the powder charge is fired in the gun, the piston being forced to move, acts through the pulleys, thus pulling the car suddenly forward along the tracks at a speed of sixty miles per hour, carrying the plane with it.

When the car reaches the end of the track, it is stopped by means of hydraulic

and spring buffers. The plane, with its engine going at full speed is automatically released from the car, and continues under its own power.

In the test at the Naval Air Station, a single seater scouting monoplane, of the hydroplane type was used. The plane left the catapult car and continued its flight without any drop in altitude below the level of the tracks, which is unusual. This fact was particularly pleasing to the officials since heretofore it has been necessary to have the tracks at such a height above the water that catapults were impracticable for several types of ships on which it was desired to have them installed.

The principal advantage of the gun type catapult over the compressed air type lies in the speed and facility with which a number of planes may be catapulted from a plane carrier. In using compressed air, it is necessary to recharge the air tanks after each shot, which takes considerable time. By the use of the gun type, the enormous space and weight of the air compressing machinery will be obviated.

All airplane carriers and other types of ships carrying airplanes, will be equipped with the gun type catapult as soon as the Navy Department can build and install them.

MODERN CLOTHING TRACED TO ROOF OF STONE AGE HUT

Neolithic woman's crude efforts to constuct a roof for her primitive hut gave rise to the manufacture of silk stockings for modern girls. Prof. Harris Hawthorne Wilder of the Department of Zoology at Smith College has traced the history of weaving back to the stone age shelter and even suggests that the apes started the practice which is responsible for twentieth century dress goods.

"The chimpanzees and orang-outangs of the present day," he says, "construct for themselves serviceable nests, and twine above them the smaller branches, interlacing them as well as their thick fingers and inferior brains will permit. But the primitive woman was far above this, and, in her twig-twining there soon grew beneath her supple fingers a definite system, by which, perhaps, one set of twigs interlocked in a fairly regular fashion with a set in the opposite direction. Next she made baskets, constructed like the hut, but made small and fastened to her back, they greatly facilitated her work of burden-bearing.

"She then developed the new found art still further and applied it to the construction of large mats, with which to cover the ground of the hut. In searching the forest for plant stems she discovered the characteristics of the fibers of flax. In some way, too, she noticed the peculiar virtue of sheep's wool which was at first left upon the hide and employed like other furs. Twisting small tufts of wool between the thumb and finger draws them out readily into threads, and this perfectly natural motion was probably often indulged in in idle moments before the idea was seized upon and definitely applied. A fairly good yarn can be made by the fingers alone, but the twisting can be more rapidly and easily accomplished by the use of something that can be made to rotate after the principle of a top. Thus came the spindle and spindle whorl.

"The simple stitches learned in basket-making were undoubtedly used first in weaving with the more pliable materials. But soon the greater possibilities were taken advantage of, and the fabrics and colored patterns that were achieved in the

valleys of the Danube and Rhine before the horse was tamed or the use of metals learned, rivaled in beauty the costumes of modern peasantry in countries where primitive methods are still used.

"The native inhabitants of the two Americas often use in their weaving exactly the same process that the woman of the Neolithic age employed. Studies of the American Indians are of the profitable ways of tracing the development of textile industries."

READING REFERENCE - Mason, O. T. Woman's Share in Primitive Culture. New York, D. Appleton and Company, 1894.

TROPICS CAN FEED JAPAN AND CHINA

Land enough to supply all the food wants of Japan, China, the Philippines, and other countries in eastern Asia exists in the tropical islands of the far east, Dean E. D. Merrill of the College of Agriculture of the University of California recently told members of the Pacific division of the American Association for the Advancement of Science.

Borneo, Sumatra, and New Guinea, each of them larger than Japan proper, have a combined population of less than 9,000,000 as against 70,000,000 persons in Japan. Java supports a population half as large as that of Japan on a territory only about 30 per cent. as large. The future food supply of the East will have to come largely from these great areas of untilled land in the tropics, Dr. Merrill said.

Even in China there is room for a considerable expansion in food production, if rinderpest, a cattle disease which makes cattle raising unprofitable there, could be eradicated, the speaker said. Large areas of China are typical grazing land, and while the country imported large quantities of rice, it exported a great many food specialties, particularly eggs.

"Unless one has traveled in the Malay archipelego, one's ideas as to the size of the region are apt to be rather hazy," Dr. Merrill said. "If a map of the archipelego be drawn to the same scale and placed over a map of the United States, the northern end of Sumatra would appear on the coast of northern California, Oregon, or Washington, while a large part of the great island of New Guinea would extend into the Atlantic ocean.

"To these vast undeveloped areas may be added large regions in the Malay peninsula and the Philippines. It would seem desirable to develope some of these regions as basic food producing areas, and this development may be forced, in the not distant future, by changing economic conditions. To develop these countries, however, labor must be available in the form of largely increased population; yet there is always the personal element to be considered in that Malay peoples are in no sense colonizers."

Germany is buying American mules to replace oxen in agricultural work.

HOT CANNING METHODS ADVISED BY EXPERTS

Housewives preparing for their summer canning season are advised by the U. S. Department of Agriculture to use the "hot pack" method of canning rather than methods which involve placing the material in the cans when in a cool or chilled condition. The reason given for this recommendation is that it has been found that it takes much longer for heat to penetrate to the interior of a jar of fruit or vegetables than formerly was supposed.

The process now recommended involves a short precooking of the material, and then placing it in the jars when it is still as hot as possible. The precooking causes shrinkage, but no food value is lost if the hot liquor that has cooked out is used instead of water to fill the jars. It is recommended tha the pressure canner be used for all vegetables except tomatoes.

The use of this process will reduce to practically nothing the danger from botulinus infection in canned foods. Most of the fatal cases of this form of poisoning that have been recently reported have followed the eating of home canned rather than commercially canned vegetables. In nearly all these cases the material was canned by the cold pack method, whereas commercial canning is now done in process canners which raise the temperature of the contents of the can above the boiling point of water.

Although the botulinus toxin is destroyed by a few minutes exposure to boiling heat, the spores of the organism are very resistant to heat and may survive in a can of vegetables that has been heated enough to kill all the putrefactive bacteria. If the material is chilled before putting into the can it takes that much longer to heat it sufficiently, in fact to make an ordinary jar of vegetables such as corn, string beans, or spinach, surely fatal to the botulinus spores it would have to be cooked many hours.

By the use of the process canner this may be reduced to a matter of minutes if the material is packed when hot. Fruits and tomatoes are naturally acid and inhospitable to botulinus infection, and may be canned in the ordinary way, if the cans are filled with hot juice or syrup.

CUTTING SOME FORESTS MAKES RAIN

Although throughout most of the world the influence of forests is to increase rainfall through increase of the humidity of the atmosphere or at least to equalize conditions throughout the year, a curious reversal of this action has been reported from Australia. Some trees there are resistant to drought through their ability to retain to the utmost what moisture they contain, giving off very little of it to the air. It has been found that if this type of forest be cut off and replaced with grass and farm crops, more moisture gets into the atmosphere and an increased rainfall results. Mountain forests increase rainfall through their ability to condense the moisture of low clouds and fogs.

Exports of electrical apparatus and machinery for the first four months of this year showed an increase of nearly 25 per cent. over the same period of last year.
