

SCIENCE NEWS

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THE TEMPERATURE OF THE SUN

THE interior of the sun must have a temperature of 70,000,000 degrees Fahrenheit, at the center, which gradually decreases until it is only about 10,000 degrees at the surface. That this is necessary to keep the sun at the size it is at present, and to prevent the gravitating mass of the outer part from collapsing to the center, is the opinion of Professor A. S. Eddington, professor of astronomy at the University of Cambridge, stated in a series of lectures at King's College, University of London.

As a result of this conclusion, says Professor Eddington, "no source of energy is of any avail unless it liberates heat in the deep interior of a star." This, he believes, effectually disposes of an idea, suggested in the past, that the sun received its energy from meteors which fell into it from outer space. "Clearly," he states, "you can not maintain a temperature gradient by supplying heat at the bottom end. If this year the sun encountered a swarm of meteors which bombarded it with enough energy to furnish a year's supply of radiation, that would not add a year, or even a day to the life of the sun; its internal readjustments would go on unaffected. All that would happen would be that the sun would give us twice the normal amount of radiation this year."

The theory once proposed that the sun is gradually contracting, and so releases the energy which forms the heat, is also untenable, says the astronomer, because with such a theory the sun can not be more than 46,000,000 years old. "Physical and geological evidence seems to be conclusive," he says, "that the age of the earth—reckoned from a period which by no means goes back to its beginnings as a planet—is much greater. The age of the older rocks found from their uranium-lead ratio is generally put at 1,200,000,000 years; lower estimates have been urged by Professor Joly, but none low enough to save the contraction hypothesis."

Astronomical facts also support these ideas of the age of the solar system, and so, according to Professor Eddington, "we seem to require a time-scale which will allow at least 10,000,000,000 years for the age of the sun; certainly we can not abate our demands below 1,000,000,000 years.

"Since we can not very well imagine an extraneous source of heat able to release itself at the center of the star, the idea of a star picking up its energy as it goes along seems to be definitely ruled out. It follows that the star contains hidden within it the energy which has to last the rest of its life. But energy can not be successfully hidden; it betrays itself because it has (or because it is) mass. How much of the sum total of the energy of the sun is capable of being converted into radiation we do not know; but if it is all available, there is enough to maintain the sun's radiation at the present rate for 15,000,000,000 years. To put the argument in another form, the heat emitted by the sun each year has a mass of 120,000,000,000 tons; and if this loss of mass continued there would be no mass left at the end of 15,000,000,000 years."

Since all the other alternatives are eliminated, Professor Eddington supposes that the source of the energy must be in the protons and electrons, charges of positive and negative electricity, of which the atoms are composed.

"We have to suppose," he says, "that a proton and electron run together, their electric charges cancel and nothing is left but a splash in the ether which spreads out as an electromagnetic wave carrying off the energy."

He admits the difficulty of some of these ideas, for apparently at a temperature of 70,000,000 degrees the energy is liberated so copiously that he asks, "Can we suppose that energy issues freely from matter at 70,000,000 degrees as steam issues from water at 212 degrees? I think that physicists would be hard put to it to reconcile such extraordinary behavior with any accepted principles, yet that is what the astronomical observations taken at face value seem to insist."

In a reply to this suggestion, Professor J. H. Jeans, president of the Royal Astronomical Society, denies that this can happen, for, he says, the transformation of matter to energy itself is a process which liberates more heat, and, "as soon as the center of a star reached 70,000,000 degrees, the heat generated would raise the neighboring parts to 70,000,000 degrees, these would generate more heat, and so on, the high temperature spreading explosively throughout the star. The true analogy would be, not the issue of steam from water, but the explosion of a magazine of gunpowder."

RADIATION FROM THE SUN

THE sun is a mass of intensely heated gas composed of layers which revolve at different speeds, the outer layer travelling the fastest and the core slowest.

This "revolutionary" idea of the structure of the sun was put forward by Dr. J. H. Jeans, secretary to the Royal Society, at a recent meeting of the Royal Astronomical Society, of which he is president.

Long after Galileo Galilei first noted how sunspots appear to travel across the sun, and concluded that our luminary revolves round its axis once in about twenty-seven days, scientists believed that the sun was a solid body, rotating as a whole, just like our earth. And even when it was realized that the sun was much more like a gas than a solid, it was generally believed that all parts of it rotated with the same speed. Now Dr. Jeans thinks that the sun consists of many layers of gas moving at different speeds, and he justifies this view by the now accepted theory that radiation is of material nature: as such it can not pass freely through the body of the sun, and as it travels from the hot center to the cooler surface it puts an increasing brake on the rotating layers and ultimately reduces the speed of the outer layers to a mere fraction of that of the inner. This reduction in speed with increasing distance from the center reminds us of the planet Neptune, the outermost member of the solar system, which revolves round the sun once in 165 years, the earth once in a year, while Mercury, the innermost planet, revolves once in 88 days.

CHEMILUMINESCENCE

"CHEMILUMINESCENCE" is the term applied to a new kind of light caused by chemical reactions which involve no burning or combustion. The practical application of this principle, according to advices received in London, has been worked out in a factory in Hungary where a tube has been devised in which chemiluminescence reactions can be carried out in a vacuum.

The materials which have thus far proved most successful in this capacity are chlorine gas and sodium vapor. These two elements brought together in this form combine to produce sodium chloride, or common table salt, giving off in the process a brilliant yellow light. About one tenth of the energy involved in this reaction is converted into light.

It is expected that such tubes will find practical use for special scientific experiments and among surgeons, due to the fact that the light they give off is of only one color and not composed like ordinary daylight of all the colors of the spectrum.

An idea following somewhat similar lines has been devised in this country for making luminous compounds. According to a patent recently granted, the phenomenon of phosphorescence can be produced by the reactions of two classes of substances known as "luminophores" and "phosphorogens" with a base of some mineral carbonate and a combustible material like starch or sulfur. Luminophores are compounds of the lighter metals such as sodium and potassium, while the phosphorogens are compounds of heavier metals like silver, nickel and the radioactive uranium and thorium. These latter make the limestone base phosphoresce and the former impart the desired color to the glow.

ZINC AND MARINE PESTS

SHIPS with zinc bottoms would never be fouled with barnacles. It has been fairly well known that there is a great difference in the ease with which marine animals grow on various metals, but it has never been exactly clear which of the latter were the most resistant or why. Professor G. H. Parker, of Harvard University, has undertaken to clear up some of these points by experiments conducted at the Marine Biological Laboratory at Woods Hole, Mass.

Metal plates were suspended in a wooden frame in the sea water of a pond with strong tidal circulation and after six weeks' submergence marine life was established on some of them half an inch thick. Aluminum, iron, tin and lead, it was found, sustained luxurious growth, but the surfaces of the copper and zinc plates were practically free.

The chemical explanation lies in the fact that the ions and soluble compounds of the heavy metals such as these are usually extremely poisonous. Where they are liberated from a metallic surface, such a surface is protected from organic growth. This is the case with zinc and copper, but the products of marine corrosion with the other four metals are insoluble; consequently the barnacles and their allies grow over them unchecked.

Professor Parker says, "By coupling copper with metals higher in the electromotive series, this metal can be

rendered chemically inactive in sea water and, under such circumstances, animals will grow freely upon it. Zinc in this respect is much less easily controlled, for it lies high in the electromotive series and consequently it is not open to the electrochemical protection that copper is. Its compounds, moreover, are relatively freely soluble and thus become very effective in checking the growth of animals."

A NEW MEGAPHONE

A NEW megaphone which distributes sound over a greater area has been developed by Professor F. R. Watson, of the University of Illinois, authority on acoustics. Already cheer leaders at the universities of Illinois, Michigan, Wisconsin and Minnesota have adopted the new instrument and indications are that its use will soon become widespread.

The megaphone is constructed of tin; it is only a foot and a half in length and strangest of all, has only a narrow rectangular opening. It is almost flat in appearance and is used in a horizontal position with the rectangular opening in a vertical plane.

Construction of the megaphone is based on the sound diffraction theory that sound passing through a narrow aperture spreads out. The ordinary megaphone differs from Professor Watson's in that sound passing through it tends to travel only along the axes of the megaphone and not sideways. It permits only the people in front of the announcer to hear.

Sounds issued through the narrow opening of the new megaphone spread out in a wide area. The commonly-used megaphone can be used only to direct sound audibly along one plane.

Professor Watson conceived the idea of the invention more than ten years ago when he began research in acoustics. He developed it this year upon the request of Illinois athletic officials who became concerned as to how cheering could be better conducted in the large Illinois Memorial Stadium and the Illinois Basket ball Gymnasium.

Since the announcement of the invention, Professor Watson has received many requests concerning information about its construction. He is interested in having the instrument adopted and will willingly answer any questions.

THE EXTERMINATION OF THE AMERICAN CHESTNUT

THE problem of quickly using up in the next few years the chestnut trees growing on the 33,000,000 acres of south Appalachian woods is confronting the U. S. Forest Service and the forestry departments of the various states to-day. Dr. G. F. Gravat and R. P. Marshall, forest pathologists of the U. S. Department of Agriculture, estimate that 80 per cent. of all the chestnut trees in more than half of the south Appalachian region will be blighted by 1930. By 1935 it is believed that nine tenths of forest area will have passed that stage.

Because the lumber shortage is already being felt in the United States, owners of chestnut trees are urged by the department to utilize their timber before the rot-

ting that follows the blight has caused heavy losses. Tests made by the U. S. Forest Products Laboratory have shown that the blight alone does not impair the strength or durability of the wood. But like a tree ringed with an axe, a blight-killed chestnut when left standing is soon rotted by the wood-decaying fungi that gain a foothold in the dead tree.

The survey of the blighted area which was begun in 1924 and is still going on has shown that the fatal infection has now reached the southern limit of the commercial chestnut area. No practical control is known.

The organism that is killing the American chestnut by the wholesale is a foreign fungus that was brought into this country on contaminated nursery stock from Asia a few years ago. In its native home the fungus was not as deadly as in America for the trees had acquired a sort of immunity. Many foreign varieties of chestnut are being imported now with the hope of finding a blight-resisting kind to replace the ones destroyed. While none has yet been found that is wholly immune, a hairy Chinese variety and a Japanese chestnut have shown some natural resistance.

The American chestnut supplies half the tanning extract used in this country in the manufacture of leather, and with the species facing extermination, a new economic problem must be met.

THE EELS OF THE PACIFIC

THE man who found out where the eels of Europe and America go when they disappear in the fall has set out to solve a similar problem in the Pacific Ocean.

That the breeding ground of the common fresh water eels of both countries overlap in a section of the Atlantic south of the Bermuda Islands, a location thousands of miles from their summer homes, was ascertained largely through the researches of Dr. Johannes Schmidt, of the Carlsberg Laboratories of Copenhagen. For the last twenty years he has been studying young eels picked up in nets from points all over the Atlantic, working much of the time under very primitive conditions. The young eel larvae of both the American and European eels are hatched in the mysterious Sargasso Sea. How these elvers know which continent to make for when seized by the migratory urge to reach fresh water is a question the scientists refrain from answering, but, according to Dr. Schmidt, there is no record of their ever having made a mistake.

Having settled the question of the common fresh water eels which breed in the Atlantic, he has now turned his attention to those found in the Pacific and Indian Oceans about which there is very little scientific information available. He has just spent two months in Tahiti where he has collected a large mass of material and data that will be worked up and studied on his return to Copenhagen and from which it is hoped valuable information of the life history of the Pacific eels will be obtained.

During his stop in Washington Dr. Schmidt was made an honorary member of the Washington Academy of Sciences.

ITEMS

MANY of the creeks and roads of the Southwest may have had their origin in the paths worn by feet of the now almost extinct bison. Scientists in making a survey of the semi-arid lands of this section say that within comparatively recent times well beaten cow paths have worn down lower and lower until heavy spring rains, finding them a convenient outlet, have eroded away a permanent channel. In this way, according to scientists, some of the larger streams may trace their beginning back to paths made by the prehistoric mastodons. The development of bison and cattle trails into modern public highways has followed a somewhat similar process of evolution. The trails leading from the range lands to the markets of the North opened up passageways that the covered wagon found a convenient guide on the long trek to the Southwest. With the steady onrush of civilization the wagon roads of yesterday have become the concrete highways of to-day.

LUBRICANTS and proper size pulleys increase the life of rope, I. P. Blauser, of the University of Illinois, has learned after a study of conditions which benefit its use. Exterior coatings and lubricants prevent external wear and the rotting of fibers, he has found, while the proper size pulley checks internal destruction. The proper pulley should have a diameter which is at least eight times the diameter of the rope. A pulley at least seven inches in diameter should be used for a rope seven eighths of an inch in diameter, he claims. Useful exterior coating for rope may be made by mixing beeswax, black lead and tallow. Another covering may be prepared by mixing black lead, tallow and resin, while pine tar alone makes a useful coating in many cases, he has explained further. "If the mixtures are applied hot and while the rope is running over a pulley, it will be found that the preparation will penetrate a great deal better," Blauser stated in his explanation. "Mineral oil gives good protection against dampness and penetrates excellently."

CHEAPER, simpler processes in linen manufacture with a finished fabric less likely to fade are the results of the year announced at a recent meeting of the Linen Industry Research Association at Belfast. Since the making of linen involves many laborious and complicated processes, calling for the services of from four to six times as many workers as the production of an equal amount of cotton, any simplification is extremely desirable. A superior new strain of flax of Russian origin, more than a ton of which has been developed from a single seed planted fifteen years ago, is calculated to yield a plant of even growth, a very valuable quality, since the element of waste in the field has always been, in the past, a decided factor of loss. The spinning operations have been considerably simplified while the difficult aspects of bleaching and dyeing have received much attention with a view to diminishing the excessive loss in weight and changes which affect the dye-absorbing properties of the fibers.