



Man-Made Lightning That Rivals Nature's Thunderbolts



This Remarkable Photograph of an Electrical Laboratory Experiment Shows Ten Million Volts of Artificial Lightning in a Blinding, Cracking Flash, Leaping Across a Gap 30 Feet Wide Between Two Needle Points, and Producing an Arc of 60 Feet.

TEN million volts, of electricity, which is twice the power of any thunderbolt ever before produced by man in electrical laboratory experiments! This enormous voltage, which can produce an arc of 60 feet, has been made possible by a new fifty-million kilowatt generator perfected in the engineering laboratories of the General Electric Company.

Not all of the exact characteristics of the 10,000,000-volt discharge are known, as this high voltage has been attained for the first time. Likewise, the fields in which the new high voltage will be

used experimentally or otherwise are yet to be determined, but it will be used in the continued research being conducted by electrical engineers in the study of natural lightning, its effects on electrical generating and transmission apparatus, and ways of protecting such apparatus from damage by lightning. With the increased voltage now available in the laboratory, it becomes possible for the engineers to approximate more closely the effects of natural lightning.

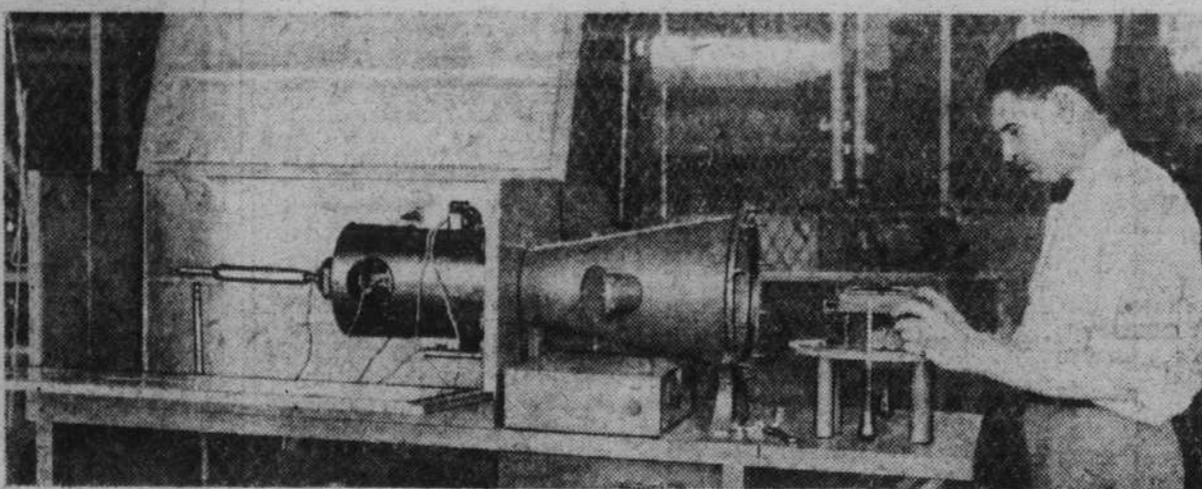
"Whether or not this high voltage will produce cosmic rays or split the atom,

these things, we haven't had time to investigate yet. "While the limit of voltage directly produced by man has now been increased to ten million volts, the voltage indirectly produced as a result of reflection is a doubling of the ten-million-volt impulse at the ends of a transmission line. In this respect the voltage is like a water-wave, which upon striking a wall doubles upon reflection.

"Natural lightning is of the order of 100,000,000 volts (10 times that of laboratory lightning), 200,000 amperes, and the discharge occurs in a few milliseconds of a second.

"Mastery of lightning problems has been removed from the realm of the 'medicine man.' While there is still much to learn, lightning may be said to be now at least on an engineering basis,

How Electrical Force Has Been Taken from the Realm of Magic and Tamed to Do as Science Bids.



The Cathode Ray Oscillator, or Electronic Camera, Which Was Used in Photographing the Ten-Million-Volt of Man-Generated Lightning.

since it is expressed numerically in volts and amperes.

"The following indicates how rapid the progress has been: The wave shape of lightning has been pictured by the cathode ray oscilloscope, or high-speed camera; the time required for a cloud to discharge has been measured by the same oscilloscope; the attenuation of lightning waves traveling on a transmission line has been determined; natural lightning waves have been reproduced in the laboratory, where their effects on transmission lines, insulation, insulators, and transformer and protective apparatus have been studied at will.

"It is now possible to design transmission lines free from lightning troubles or interruptions as well as lightning-proof transformers and other electrical apparatus. It has also taught us how to build efficient protective devices to guard other electrical apparatus from lightning disturbances.

Lawless lightning, which acknowledges no regulations of man's contrivance, committed one serious error of judgment in its ageless career when it flashed in lurid fury from the storm

garded this visitation as a stroke of fortune, although if he had been in the camp at the moment he would have been a victim of the lightning bolt. For days afterward Mr. Steinmetz poked around amid the debris, examining everything, noting everything. He even pieced together a mirror which had been shattered by the lightning.

Then he began to think over the ideas which the experience had created in his mind. Eventually he got the notion of imitating lightning, and within a year he had designed and built a lightning generator which produced thunderbolts. This was the beginning of a serious investigation of lightning, the object of



This Curious-Looking Corallike Formation Is a High Voltage Fulgurite Produced in Sand by a Bolt of Artificial Lightning.

which was to protect electric transmission lines from the attacks of the "criminal" bolts and to render these lines so immune from lightning that interruptions in electric service to homes, offices and factories would be reduced to the vanishing point.

Now the Photographer "Wears" His Camera



A Photographer "Wearing" a Portable Darkroom and Camera Which Enables Him to Take Pictures and Complete Them for Delivery Without Leaving the Spot.

the wearer's boxlike costume was serving a most usual purpose. Surprising to announce the box affair was a camera with a complete dark-room attached, including its own developing, printing, and finishing compartments stocked with the necessary chemicals.

This device enabled the photographer to take his pictures, finish and deliver them on the spot to his customers.

The camera is installed at the front of the box, on the right side of which is an opening through which the photogra-

pher thrusts his right hand when taking a picture to manipulate the various controls that enable him to secure the proper focus and operate the lever that controls the time of the exposure.

Openings at the top and bottom of the box permit the protrusion of the cameraman's head and legs. A special dark-room window is inserted at the top so that the photographer easily can see within the cabinet while he is developing his negatives and completing his pictures.

PEOPLE who were present at a recent outdoor sports meet in Birmingham, England, were treated to the very odd sight of a man dressed in what appeared to be a large black box. Anyone who jumped to the conclusion that the man has lost his clothes and was garbed in a box instead of the customary barrel was greatly mistaken. The utter lack of embarrassment and the nonchalance with which the strangely-clothed man mingled with the crowds, indicated that his curious garb was being worn to serve some other purpose, which, by the way, it really was.

Investigation disclosed the fact that

The First Mustard

WHEN Shakespeare wrote, "What say you to a piece of beef and mustard?" he had not in his mind the yellow condiment of today. In the sixteenth century mustard was a piquant sauce, which varied according to the special recipe treasured by individual families. As the flavor improved by keeping, it was prepared in bulk, being ground in a mortar. Black mustard seed only was used, this being infinitely superior to the white.

It was not until 1720 that powdered mustard was sold commercially, and it was a woman who made the first venture. Mrs. Clements, of Durham, England, ground the seeds in a mill, and sifting the flour from the husk first, produced the now familiar bright yellow powder, calling it "Durham mustard."

Do Plants Really Have Brains?

GROWING plants may have "brains" and display reasoning power, according to an announcement of the Smithsonian Institution at Washington, D. C. The discovery was made by Dr. Earl S. Johnston, who, it is reported, has found in plants a striking similarity to the intelligence of human beings.

Dr. Johnston centered his experiments on the mysterious ability of plants to turn their stems and leaves toward the light. He concludes that every plant behaves as though it had a more or less localized region, a sort of "brain," that reacts directly to the stimulation of light. In seedlings of oats and wheat, the supposed brain is centralized in the tip of leaf sheath that encircles the bud of the growing shoot. The first millimeter (about 1/25 of an inch) is 180 times as sensitive as the second and 1,800 times as sensitive as the third. European experimenters had already discovered that if they cut off the head of a seedling it lost its power to turn toward the light, but regained it when the tip was grafted back on again.

Now Dr. Johnston is investigating the mysterious manner in which this "brain" operates, if it exists, and how it gets its

message to the lower part of the plant's stem where the bending occurs.

His method of studying this process, as explained in Popular Science Monthly, consists of exposing growing seedlings to light of different colors. Plants are selected for their straightness and set perfectly upright in a cabinet, exposed on each side to light of a different color. After half an hour the bending of the plant toward the light having the stronger effect may be observed with a telescope. By delicate control of the lights' intensity and wave length, a precise comparison of their effect may be made. Blue light proves most exciting.

Portraits on Wood

PORTRAITS are made on wood by a California artist who follows the grain of the wood in bringing out the lights and shadows necessary to produce a picture. The artist, who has worked thirty years on the process, says the wood-grain portraits will not fade. The process calls for working the portrait into the grain so that it becomes part of the wood and can be removed only by scraping or cutting the surface.

Worship of Cats

NEARLY a thousand years before the Christian era the cat was worshipped in Egypt as a goddess being then supposed to be the reincarnation of Bast, the Goddess of the Sun. Death was the penalty meted out to all who punished a cat or caused its untimely end, but when dead the cat was mummified and buried with pomp and splendor in Bubastis, the City of the Goddess of the Sun.

The cat has always been held in the highest reverence in Egypt. Even today many of the fellahen still believe that the souls of sleeping babies enter into the beings of cats, and thus a real Egyptian will never willingly kill a cat in case he should slay the soul of the child as well.

In the hinterland of Egypt the greatest compliment one woman can pay another is to tell her that her eyes are like those of a cat.

Why You Have Ten Senses

EVERY normal human being not only has five senses, but also a sixth sense, proverbially counted as missing. In addition there is a seventh sense, too, an eighth, a ninth, and even a tenth, with an additional probability that some of these should be divided or others added to make a total of fifteen or twenty. The chief ten and some possible divisions are listed by the American Medical Association.

The sense of sight really is triple, according to this authority, since it includes perception of three different things, light, form, and color. Touch includes a sense that records changes of shape of the skin, a sense of vibration, tickling, and a sense of strain or pressure perceived by nerve endings deep in the muscles.

The remaining three of the conventional five senses, taste, smell, and hearing, the Association lists as single and uncomplicated.

Of the five other senses listed, one is the temperature sense residing in special nerve endings in the skin, which enables one to distinguish between hot and cold objects.

Another sense includes the sensations from muscles, tendons, and joints, which enable one to sense the movements of the body or the positions of legs or arms.

Third of the list is the sense of up-

right position supplied by the leveling mechanism close to the inner ear. This enables a person to keep his balance.

Next is listed the pain sense found in the skin, the muscles and the blood-vessels.

Completing the list of ten are the sense stimuli from internal organs, which are believed to affect such automatic actions as breathing and the beating of the heart.

Waterless Fuel

A DEVICE that removes water from gasoline has only one moving part, a delicately adjusted float that sinks in any liquid of a lower specific gravity than water. Any unusual influx of water causes the float to rise and allow the water to flow directly through the chamber and escape. Water in minute quantities in the bottom of the chamber until its level is high enough to actuate the float.

The largest model thus far developed delivers 150 gallons of pure gasoline a minute, while others are small enough to install on the feed line of an airplane or automobile. It is said to be so sensitive that it can separate cold water from hot.

How "Fins" Give a Boat High Speed

BY reducing resistance instead of increasing power, Dr. Oskar G. Tietjens has devised a method of almost doubling the speed of water craft up to 50 feet in length. While the idea of lifting a boat with fins is not new, Dr. Tietjens, who is a research engineer of the Westinghouse Electric and Manufacturing Company, applied his knowledge of hydro- and aerodynamics to the task of raising the craft completely out of the water with a couple of streamlined planes with cross sections similar to those of an airplane's wings. He believes it is the first time that this has ever been done efficiently without losing stability. Dr. Tietjens' method of controlling the rear plane keeps the boat level at all times and prevents plunging and dipping unless the waves are higher than whitecaps.

"Frictional resistance in water is 800 times the wind resistance of the same surface in air," Dr. Tietjens says, "because water is 800 times as dense as air. For the same reason the lifting force of a submerged plane is 800 times as great as for the same plane in air, area and speed being equal.

"In water the frictional resistance of 'drag' of present type high-speed craft is one-sixth of the buoyancy or lifting effect of the water. For the new type this 'drag' is only one-twentieth of the lift.

"By making practical use of these facts, the speed of a motor boat capable of 25 miles an hour in water will be raised to 40 miles an hour with no increase of power when lifted into the air by the submerged planes."

Dr. Tietjens believes that the idea practical in this form for boats ranging in size from 12 feet to 50 feet long.

In his model of this new boat, Dr. Tietjens attached the planes to the hull just forward of amidships. To the ends of these sections and extending across beneath the hull is the main plane. For the 12-foot craft, Dr. Tietjens calculates a steel plane eight inches wide would be entirely adequate.

Just forward of the propeller is the second plane, so hinged that it controls vertical direction and stability much as do the "flippers" on airplanes. As the skipper lowers the forward edge of the rear plane, it cuts down, lowering the stern of the boat. This automatically increases the lift of the forward plane so the

nose of the craft climbs out of the water as speed increases.

Manipulation of the rear plane in conjunction with the rate of speed maintains stability, keeps the cruiser level and above a certain speed the entire hull is out of the water. In this position the boat is riding on the two narrow planes.

Dr. Tietjens considers an outboard motor particularly suitable for this new type of high-speed water craft.



A New Model of Boat Equipped with Streamlined Planes, Similar to an Airplane's Wings, Which Double the Speed of the Craft Without Increasing Its Engine Power.