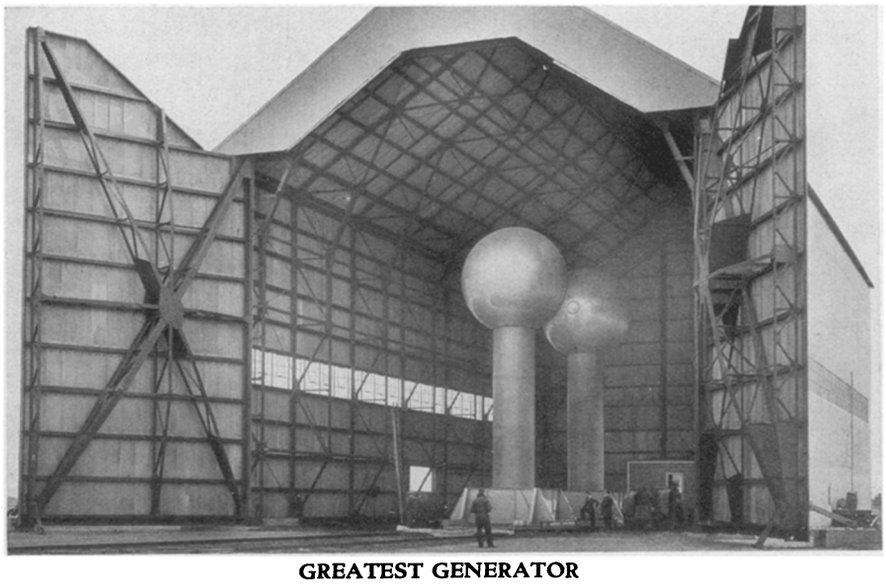
sets about three hours after the sun, and can be seen before that low in the southwest. On December 31 it will reach its greatest brightness. Then it will be of magnitude minus 4.4, far more brilliant than any other star or planet. Farther west, and considerably fainter, can be seen Mars. Saturn is farther to the east of Venus in the early part of the month. On December 21, at 5:00 a. m., the two planets pass, at which time Venus will be 20 seconds, about two thirds the moon's diameter, to the south. But, of course, at that hour they will not be visible from any part of the United States. On the previous evening, however, they will be close together, with Venus to the west, and on the next day they will be close, but with their relative positions reversed. It will be interesting to watch them night by night through the month as they draw close together, then spread apart.

In addition, the moon enters the picture. On the twentieth, at 2:04 a. m., it passes to the north of Venus, at a distance about a third greater than its own diameter. A little more than an hour later, at 3:15 a. m., it passes north of Saturn, at a distance of about two-thirds of its diameter. This also will be invisible to Americans, but the three bodies so close together, on the nights before and after, will form a beautiful spectacle in the west. Coming just before Christmas, it will remind us of the legend of the star which the Wise Men followed to Bethlehem; for one explanation of that object was a conjunction of three planets in the western sky which occurred at about that time.

Sun Farthest South

During December, the moon goes through its phases as follows: on December 1 it is full, on the tenth at last quarter, on the sixteenth new, on the twenty-third at first quarter, and full again on the thirty-first. This will mean moonlit evenings from the first to about the third, and during the last ten days of the month. On December 22, at 1:58 a. m., Eastern Standard Time, the sun, in the course of its annual journey around the sky, reaches its farthest south position, the winter solstice, and this marks the beginning of winter. At this time, also, the sun rises latest and sets earliest, for us in the northern hemisphere. In the southern hemisphere conditions are reversed. There summer begins on this day, which is for them the longest of the year.



GREATEST GENERATOR

An airship hangar was needed to house the Van de Graaff generator.

PHYSICS

Scientists Unleash Largest Atom-Attacking Machine

SEVEN MILLION volts, man's closest approach to the voltage of nature's lightning, flashed across the gigantic ball terminals of science's greatest generator, erected by Massachusetts Institute of Technology physicists in Col. E. H. R. Green's airship hangar at Round Hill, Mass., and operated Tuesday for the first time at so great an electric potential.

Sparks forty feet long were sent arcing between the two huge metal spheres of the generator. Though the seven million volts achieved is three times the highest direct current potential heretofore attained, it is less than the generator's full designed voltage by three million volts. A full voltage test was not attempted because high wind prevented taking the machine into the open, but the designer feels confident that ten million volts will be produced on the first outdoor attempt.

This is the opening report in an investigation of some of the most important and fundamental of nature's secrets and it may have far reaching consequences in even the commercial generation of electric power.

A few years ago there was a young Rhodes scholar at that old English university, Oxford. Puzzling upon the problem of power for smashing the atom and studying its internal structure, Dr. Robert J. Van de Graaff went back to the idea of the old-fashioned static generator for electricity, the sort of electrical machine used by Ben Franklin, pioneer American scientist.

Modern electrical generation had developed along the line of electro-magnetism and Dr. Van de Graaff revived the other principle and built it into a modern machine. He went to Princeton University as a National Research Fellow, and built a small laboratory model of his generator at the cost of a few hundred dollars. It produced between 1,000,000 and 1,500,000 volts, the highest direct voltage current ever attained up to that time. Much more expensive apparatus, upon which other scientists had worked for years had been able to produce only 800,000 volts direct current.

Working with Dr. Karl T. Compton, then professor of physics at Princeton, Dr. Van de Graaff joined the M. I. T. staff when Dr. Compton became president of that school.

With the aid of associates, they visualized a giant generator, the electricity producing machine that in its tests has fulfilled their expectations.

No conventional building at the Massachusetts In- *(Turn to Page 366)*

From Page 364

stitute of Technology, was large enough to house the large Van de Graaff generator. Col. Green offered his airship dock on his estate at Round Hill, Mass., a structure 140 feet long, 75 feet wide and 75 feet high, with railroad track running into it and doors that weigh over 23 tons.

The 10,000,000 volt Van de Graaff generator consists of two large hollow columns, 25 feet high and six feet in diameter, which are surrounded by a heavy polished aluminum sphere 15 feet in diameter. Each column is mounted on a heavy four-wheeled truck running on a railway track 14 feet wide. The spheres, which act as reservoirs into which electricity is poured by relatively small static generators at the base of the columns, rise to 43 feet above the ground.

Even while the generator is running at full potential, scientists can stay and work within the 15 foot diameter aluminum spheres, surrounded by high potential electric fields.

The giant aluminum spherical terminals are unique in construction, the largest such structures of this metal ever produced. They were made by fabricating orange-peel sections which were welded and then polished to a bright finish so as to eliminate projections that would cause the electricity to spark away. Although built of light metal a half inch thick, each hollow ball weighs a ton and a half.

The spheres are charged with electricity by a process not unlike the old-fashioned method of raising water from a well by means of small buckets on an endless chain, each bucket dumping its load as it turns over a pulley at the top. Paper belts, four feet wide, convey upward the electrical charges sprayed upon them at the base at the comparatively low pressure of 20,000 volts. Or the giant generator can actually be operated without any artificial source of electricity, as it can draw the necessary electrical charges from the earth. The picture on the cover was taken with the camera pointed up one column. It emphasizes the paper belt.

When the real work of the Van de Graaff generator begins, there will be no spectacular electrical fireworks. A large vacuum tube, a foot in diameter and 40 feet long, designed by Dr. L. C. Van Atta, made not of glass as is usual but of laminated paper, will extend from one sphere to the other and the electricity will discharge through it, creating the most powerful X-rays ever known by hurling millions of electrical "bullets" against a metal target. Each of these "bullets" will be moving at velocities 100,000 times greater than the speed of any rifle bullet.

Science News Letter, December 2, 1933

PHYSIOLOGY

"Sensitivity" to Cold May Cause Death by Drowning

"PERSONS who are sensitive to cold risk their lives bathing in cold water," states the editor of the American Medical Association.

Sensitive, however, is used here in a very special sense. Certain persons, it has been found, are "sensitive" to cold, or to heat, just as hay fever sufferers are sensitive to the pollens of some plants.

These cold-sensitive persons may have hives, swelling of the skin, pain in the joints, sneezing and irritation of the nose, asthma, headaches and many other disturbances when they are exposed to cold air, cold water or cold objects.

More serious is the fact that bathing in cold water or walking in a cold, moist wind may cause severe "shock." Apparently this cold-sensitiveness may lead to death while bathing in cold water. It may be the cause of drownings that are otherwise unexplainable.

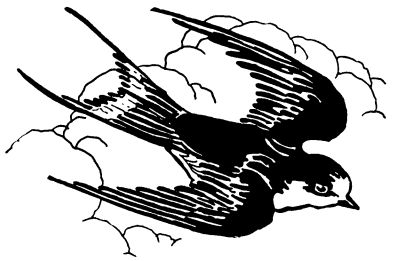
Several European physicians have reported cold-sensitiveness both in themselves and in patients which caused nearly disastrous bathing accidents.

One of these physicians has attacks of sneezing and running of the nose when he puts his foot out of the warm bed. His hands swell and become itchy when in cold water. Several times when swimming he has suddenly become so weak that he could scarcely reach the shore before collapsing. At the same time, giant hives appeared around his joints. He had a similar reaction once in a cold air bath. He is of the opinion that such hypersensitiveness to cold may be present only at times.

Science News Letter, December 2, 1933

NATURE RAMBLINGS by Frank Thone

ORNITHOLOGY



Specialists in Feathers

BIRDS seem to be about the most plastic of all the backboned animals, in their ability to develop adaptations to special requirements of their environments. Practically alone among vertebrates, they have completely conquered that most difficult of all the elements, the air; and yet they can be found competing successfully with mammals, reptiles and fish on the earth and in the water. Every environmental niche has a bird species that fits it exactly: the swallow to the air, the duck to the water, the ostrich to the desert, the stork to the swamp.

The race of birds began, apparently, by the hardest conquest of all, the conquest of the air. For this the extension of the forelimbs and the practical loss of the fingers. For this the development of long quill-feathers, at once marvelously light and marvelously strong as little sails. For this the lightening of all the bones, the deepening of the breastbone into a great keel for the attachment of the wing muscles, the heightened rate of basic physiologic processes releasing energy. For this the streamlining coat of body feathers, the remarkable steering tail.

Yet, having made this conquest, some birds abandoned it almost immediately, and became swimmers par excellence, swimmers good enough to beat fish at their own game and make them their prey by simply outswimming them. The flying wings lost their flying feathers and became paddles for the penguin. The light, grasping feet became heavier and stronger, webbed for goose and duck and gull, paddle-toed for grebe; the keel was reduced or lost where flight was no longer important; but among the birds that fly long journeys, the keel was usually kept.