

# The Mysterious Ions That You Breathe

How Electrical Particles Too Small to Be Seen by Microscopes Act as

Regulators of the Atmosphere.

**L**IGHTNING is not the only electrical phenomenon of the air, but is the most familiar. Men in all ages have witnessed the passage of electricity through the atmosphere. Each lightning-stroke represents the transmission of electricity between a cloud and earth or between two clouds.

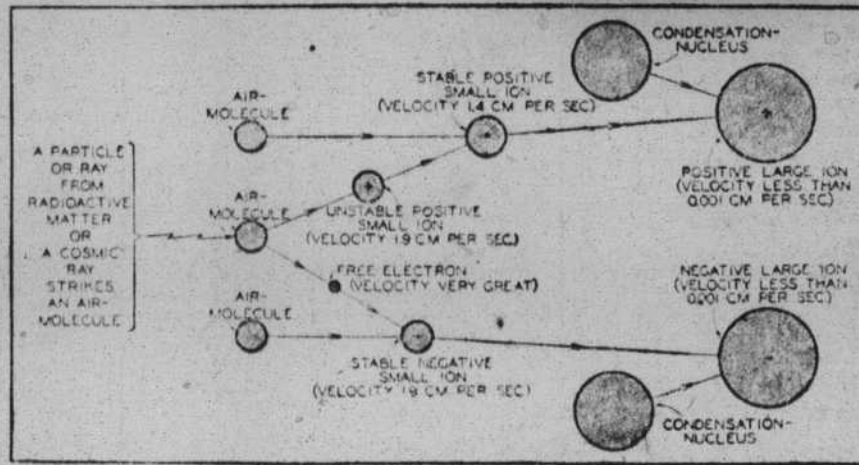
The spread of scientific knowledge has made all aware that electricity can pass through the atmosphere. Fewer perhaps are aware that electricity can and does pass through the atmosphere when no storm-cloud is near, and even on a cloudless day. Its passage is unnoticed because it is not accompanied by any audible or visible manifestations such as accompany a lightning-discharge. It was not known until recent times that this quiet electrical discharge is taking place through the atmosphere during fair weather as well as during stormy weather, over land and over sea on the mountain-tops and in the valleys. This electrical discharge takes place through the action of molecules of air that are electrically charged. When so charged the molecules of air are commonly known as the small ions of the atmosphere.

The small ions of the atmosphere are formed when certain types of radiation strike molecules of air. The energy of radiation separates the positive and negative electricity in a neutral molecule of air, thus forming a pair of oppositely charged small ions. The radiations come principally from radioactive substances in the soil and air, although an appreciable portion is contributed by the cosmic rays about which so little is known.

Small ions are continually being formed in the atmosphere. Although a number of investigations have been made by various scientific organizations to determine the character of daily and yearly variations in the number of small ions in the atmosphere at different localities, little or no effort has been directed toward obtaining an understanding of why the variation takes place, until a

study of the problem was undertaken at the Carnegie Institution of Washington by its Department of Terrestrial Magnetism. In this investigation conducted by Doctor G. R. Watt, observations are being made to determine whether the variation in number of small ions is due to a variation in the rate at which the ions are removed or to a variation in the rate at which they are formed or to a combination of the two variations.

The number of ions in the air is continually changing, but at all times it is very great. With each average breath one draws into one's lungs from 40,000 to more than 150,000 of these electrical charges. Each minute an average person will breathe in 993,000 to 50,000,000 tiny bits of charged material.



Above: Instruments Used to Count the Ions in the Air. Left: The Diagram Shows How Ions Are Formed. They Cannot Be Seen Even With a Microscope, But Must Be Examined Through Their Electrical Effects.

Ions are constantly being created in the air by various kinds of radiation. Radioactive material in the earth and in the air accords for most of them. The cosmic rays also produce ions.

The rays of light that reach the earth from the sun may also create a few, but this is a relatively unimportant source.

Ions may also be formed by forces as yet unknown. They are really the wreckage of molecules of air and are probably formed as follows:

Radiation strikes a molecule of air (air is a mixture of many kinds of molecules and atoms, but all apparently act alike in this process) and knocks out an electron. The electron goes flying off, carrying its negative electrical charge, and the remaining damaged molecule becomes a "small ion," with a positive charge. The electron finally ends its free flight by fastening to a neutral molecule, thus giving it a negative charge. It, too, is then a "small ion."

but with a negative charge.

Many of the small ions become "large ions" by combining with larger particles in the air known as "condensation nuclei," so called because water of the atmosphere condenses upon them when its moisture-content reaches the saturation-point, that is, when the atmosphere has all the moisture it can readily hold and must prevent more from accumulating.

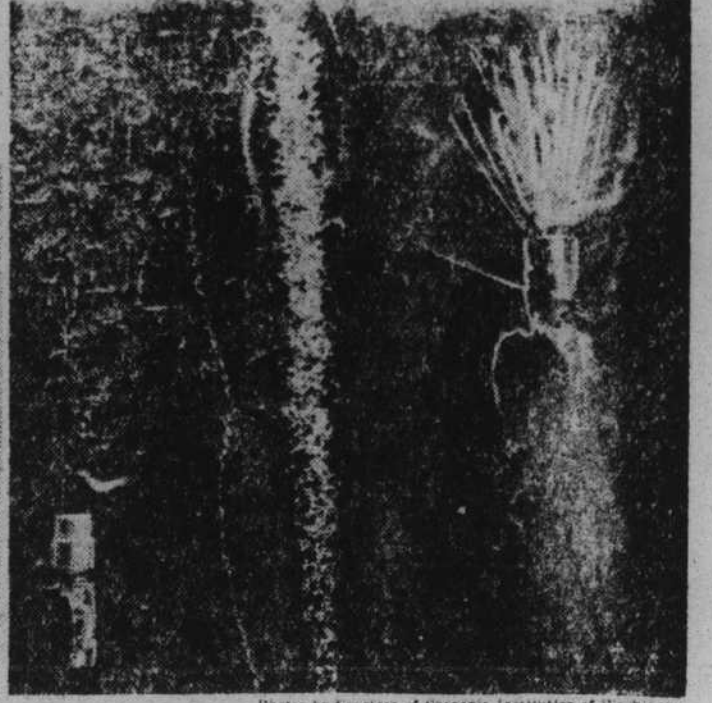
Many interesting things might be told of these particles; how they prevent the air from becoming extremely wet and uncomfortable; how without them rain could not occur except during certain unusual and extreme conditions.

Condensation-nuclei, which are suspected of playing an important part in regulating the number of small ions in the atmosphere, come into existence as products of combustion, in the smoke from homes and factories, in discharged gases of gasoline motors, and even in the exhaled air from the lungs. Other sources, of course, are known to exist and there are many no doubt that have not yet been discovered.

Whether ions in the air do good or harm is still a debatable question. Some investigators have attributed the invigorating effect of certain climates to the number of ions present in the

air there. Stiffness of closed rooms has been blamed on a shortage of ions. It is claimed that headaches may be cured by increasing the number of ions in the air breathed. However, present information is not sufficient to prove or disprove such assertions.

In constructing an apparatus to count the ions in the atmosphere, advantage is taken of the fact that a charged body attracts ions charged with electricity of the opposite sign. The charged body in the ion-counting apparatus is in the form



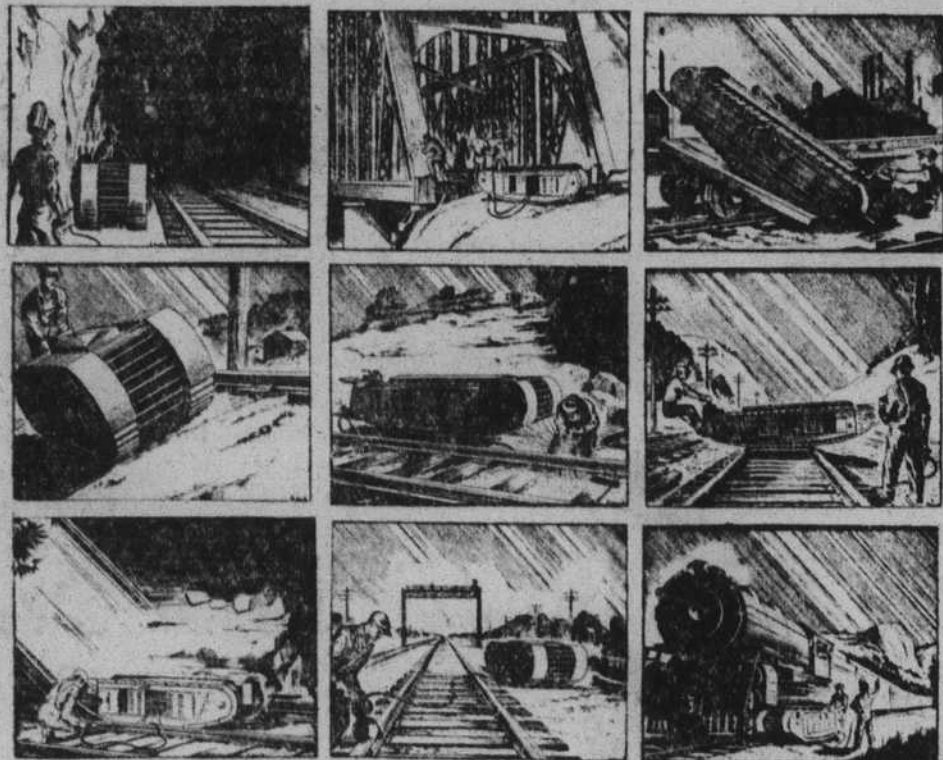
Above: Trains of Small Ions Loaded With Water Droplets. Upper Right: Alpha Particles of Radio-Active Material. Center: X-Rays and Left: Beta Particles.

of a cylinder placed concentrically within another cylinder and between the two a current of air is drawn. Ions with charge of the sign opposite to that on the central cylinder are drawn from the airstream. The central cylinder is connected electrically to a measuring device—called an electrometer—which indicates the number of electric charges coming to the cylinder, or in other words it indicates the number of ions caught.

The results of measurements made with such apparatus during the past year are shown in the form of curves, one set of which is for the warm season and the other for the cold season of the year. The curves also show the manner in which the numbers of small and large ions vary during the day and night.

The change in the number of large ions is generally opposite to the change in number of small ions in both warm and cold seasons.

## A New Caterpillar Tank



Industrial Uses of the Tank. 1. Tunnel Work. 2. Welding Bridges. 3. Climbing on Flat Car. 4. Remains Upright at 30 Degrees. 5. Welding Rail Ends. 6. Crossing Tracks. 7. Floodlights for Night Work. 8. Operating Power Tools. 9. Small Size Does Not Interfere With Traffic.

**A** NEW tank of the "caterpillar" type, designed not for war-time destruction, but for peace-time rehabilitation is a long, low and narrow tractor, completely equipped with an electric arc welding apparatus. A gasoline engine drives an electric generator which supplies current for the welding operations and for driving the machine from place to place by furnishing power to electric motor driven tread chains.

Although it weighs more than five tons, this industrial "tank" is almost as maneuverable as its wartime counterpart. It easily ambles over railroad rails, climbs an eight-foot ramp onto a standard railroad flat-car, fights up a steep thirty-degree bank and runs along side slopes as steep as 45 degrees without tipping over. It turns around in a space the size of a three-foot circle, and can extend nearly half its length beyond the top of a wall or slope without toppling over.

## Typewriter for the Blind That Writes Dots

**T**HE blind are now enabled to write by means of a special typewriter devised solely for the use of the sightless. This machine which types the Braille system of letters, has only six keys and a bar in the center which is used for spacing.

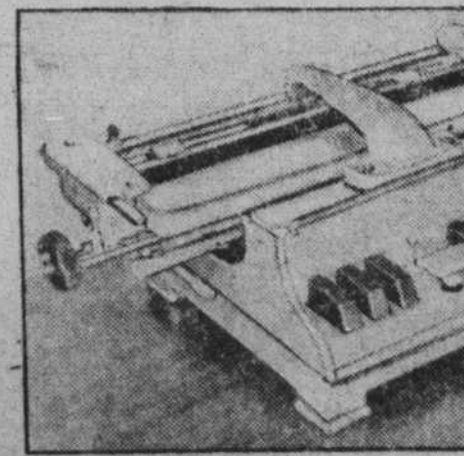
entirely of six dots punched in paper in varying combinations. There are 63 possible combinations of the six dots in an oblong, the vertical side three dots and the horizontal two. By pressing two or three keys in unison one letter is produced on a sheet of paper.

There are only half a dozen keys because the Braille alphabet is composed

The instrument originally used for writing the Braille letters was a blunt awl to produce pits in the paper. The writing is from right to left so that when the paper is turned over the blind reader can feel the prominences and read from left to right.

The Braille system, which is now in worldwide use, was invented by Louis Braille who was born near Paris in 1809 and became blind at three years of age.

The Typewriter Designed for the Sightless. It Has Only Six Keys Which Write the Dots in the Different Positions of the Braille Alphabet.



## How a Cactus Was Formed Into a Freak Face by the Process of Grafting

**M**EET the "Old Man of the Desert." He is not a hermit, as you might suppose. He is not even human, but a cactus plant which George W. Coblenz, an artist and amateur botanist of Los Angeles, caused to grow in the form suggesting a human face.

Ice plant was grafted on the cactus to form the eyebrows and hair. Such features as the eyes, nose and mouth were imprinted on the plant when it was a leaf two years ago.

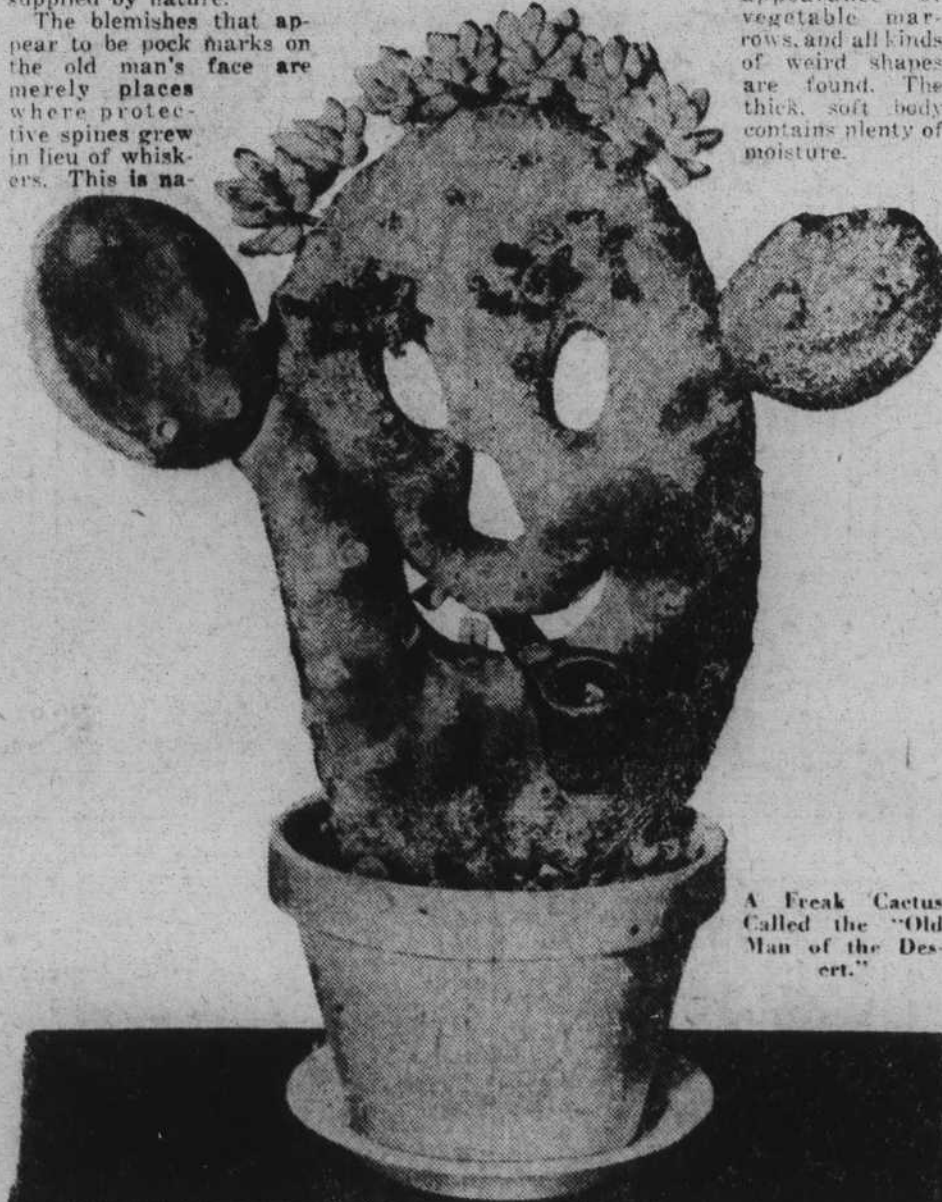
The "old man's" two teeth are false, being merely pieces of bone set in his mouth to help him hold his pipe. The large and protruding ears, however, were supplied by nature.

The blemishes that appear to be pock marks on the old man's face are merely places where protective spines grew in lieu of whiskers. This is na-

ture's method of enabling the cactus to protect itself from its enemies.

The cactus thrives on the desert where it has held its own for thousands of years. It has dispensed with leaves, and in their place there are minute spines or sharp thorns spreading out in every direction. Some of these are small and so numerous that they have the appearance of a soft fleecy covering, but any animal that attempts to eat them soon discovers that this apparently soft covering is an enemy in disguise.

The cactus concentrates all its branches or shoots into compact forms. Some consist of just one tall trunk; others have the appearance of vegetable marrows, and all kinds of weird shapes are found. The thick, soft body contains plenty of moisture.



A Freak Cactus Called the "Old Man of the Desert."

## Women Who Smoke Cheroots



A Trio of Shan States Women Enjoying Their Giant Cigarettes While They Wait for the Kettle to Boil for Their Afternoon Tea.

**K**UPLING, in his poem, "On the Road to Mandalay," has made the world familiar with the Burma girl who waits for the British soldier as she smokes "a whackin' white cheroot."

The women of the Shan States, which occupy northern Siam, a portion of eastern Burma and Yunnan are among the first smokers of cigarettes. Their favorite "smoke," however, is not the small, paper-wrapped roll of tobacco so familiar the rest of the world, but the cheroot, which is a sort of a greatly oversized cigarette.

The Shan woman is scarcely ever without a cheroot, except during her hours asleep. No matter what she is doing she is usually puffing away on one of these big cigarettes, as she evidently is of the opinion that her task is greatly lightened thereby. For example, the group of Shan women pictured in the accompanying illustration are thoroughly enjoying their big cheroots while they are waiting for the kettle to boil for their afternoon tea. No doubt the sojourn afforded by their cheroots makes the waiting less tedious before they can indulge in their favorite beverage.

## The Vulture, Ugliest of Birds

**U**GLIEST of all birds and repulsive as a creature of carrion the vulture is a pariah to man, except in India. In that land of magic and mystery the vulture is master, for it bears a charmed life because it is considered sacred.

Because of the strange religious beliefs of the Parsees, a sect of fire-worshippers from Persia who settled in India centuries ago, the vulture, as in no other part of the world, has been assigned an unusual, but very important part in the disposal of the dead. The Parsees do not believe in burying their dead, as they consider this pollutes the soil. They also do not believe in cremation, as the Hindus do, since they regard fire as sacred. Therefore, as a substitute for these two methods they take the bodies of their dead to a "tower of silence," a strange stone structure built on top of a hill. The tower is built in a circle 100 feet and more in diameter and about 20 feet high. It has no roof and the only entrance is a small door through which a body is borne and deposited inside the circular wall.

The top of the wall is crowded with a line of gruesome vultures, roosting there in a deadly silence. With the arrival of a body, however, the line of carrion birds springs into action. There is a flapping of denuded wings and an eerie screeching as the hideous scavengers swoop down into the pit. Within a few moments the newly arrived body is reduced to a skeleton, the bones being picked clean and left gleaming like polished ivory.

The beak of the vulture of India is a weapon which no flesh can resist. The



Head of a Vulture of India, Showing Its Pouchlike Ear Which Has the Sensitiveness of a Radio Receiver

coloring of the vulture's head is a ghastly grayish white, a hue of great repulsiveness.

No living creature is believed to have an eye as sharp as that of the vulture, for it can spot a morsel of carrion from a great height and miles away.

The vulture's strange pouch-like ear, which hangs down also seems to have a sensitiveness unknown to mankind for it acts almost like a radio receiver. The Parsees of India are described as a very able and intelligent race of people and are specially prosperous in a business way. They are very religious and very liberal with their charities. On a certain day of the year they gather at the "towers of silence" and hold impressive ceremonies in honor of their dead.