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WEATHER BUREAU

[METEOROLOGY]

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(METEOROLOGY)

FOR BOYS

BY

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Yale University, 1909

Published by

THE A. C. GILBERT COMPANY

NEW HAVEN, CONN.

New York Chicago San Francisco Toronto London

WEATHER INDICATIONS

A Study of the Weather

In the minds of most people a very silly notion prevails about the weather and the weather man. They have a general impression that the weather knows no laws—that it is lawless and reckless, fickle and changeable; that the weather man is a sort of conjurer, and by some mysterious gift he is able to prophesy things that most people know nothing about. Nothing could be further from the truth.

After you have carried out the simple experiments described, and have read this text, whether you have a scientific trend of mind or not, you will at least learn that the weather is a science, like electricity, chemistry, or medicine; that its laws are uniform, constant, and unchanging, and there is really nothing mysterious about it. The weather man is a scientist and by means of instruments, which indicate certain things, he comes to definite conclusions. He is not a prophet; he does not prophesy; he forecasts.

If you are interested in having a Weather Bureau station of your own, you will find it one of the most interesting things you ever acquired in your life. You will soon gain a knowledge of a subject that most people are quite ignorant of, and if you desire to stand for leadership among your boy friends, it may be achieved by knowing about those things that to most boys, and in fact to adults, assume a mysterious and magical aspect.

A Weather Bureau station at your home will give you a source of pleasure, fun, and insight into a science that is intensely interesting, easy to understand, fascinating and worth while knowing. The importance of the subject cannot be overestimated. It has an influence on the whole world; it affects our health; it affects our comfort; it means success or failure in farming; it has an immense influence upon transportation. When ready to move perishable goods, the transporter must have indications of what the weather is going to be.

The weather observer is the guardian angel of the ships at sea; some men have doubts as to whether medicine itself has saved more human lives than the study of the weather and the practice of weather observing. It is not unusual for those who live along

the coast to see ships hovering into cover long before a storm approaches, for the wonderful weather bureau system operated by the United States Government gives warnings and danger signals all over the country. Statistics show that losses have been reduced seventy-five to eighty per cent through this system. The marine warnings are so perfect, so prompt, and so efficient that for a great many years no long or hard storms have ever reached any part of the United States without advance warnings and danger signals being shown beforehand.

When a storm is brewing, the Government's wonderful Weather Bureau organization watches every atmospheric change with the greatest care and concern, and takes observations every few hours, and telegraphs the indications to all places where a warning should be given. Thereby perishable goods that need protection can be looked after. When extra hazardous storms and weather changes of a severe character are indicated, hundreds of thousands of telegrams are sent out in a comparatively short time, to all parts of the country, so that interested parties may prepare for such conditions. One can readily see the great service rendered and the satisfaction it must be to the shipper and the farmer to know that his property, which might be destroyed by a bad storm or low temperature, is being constantly and carefully guarded against danger. Not only storms and great cold waves have been forecasted, but floods have been anticipated and warnings given.

This brings us to a study of the subject "Weather," and the best way to learn about the weather is to first learn about the air.

THE AIR

If you were to ask ninety-nine people out of a hundred to take the stopper out of a bottle, to look into it, and to smell its contents, and then ask them if, in their opinion, it contained anything, the invariable answer would be: "It contains nothing."

EXPERIMENT NO. 1

Take the stopper out of a bottle and endeavor to pour water into it rapidly and see what happens. (See Fig. 1.) One of the laws in Physics is that no two bodies can occupy the same space at the same time. After doing this experiment, you will come to

the conclusion that the bottle does contain something, and that "something" is matter, and that matter is air. There is in the bottle probably as important a thing as you could possibly conceive of, because even this earth without its ocean of air would be

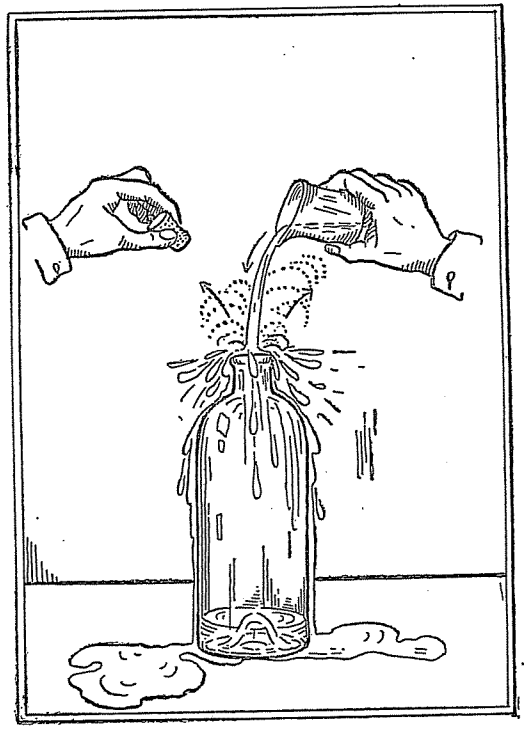

Fig. 1

a world of desolation; for air sustains life itself, and when agitated, develops great strength. It may be whirled about into a hurricane blast and assume such violent proportions that villages will be swept away, and great waves of water will be raised, upon which ships can be tossed about like so much chaff. We all know that

air can become so cold that great suffering will be caused, and so hot that it will make life almost unbearable. We really live in an ocean of air.

THE OCEAN OF AIR

As the fishes live at the bottom of the ocean of water, mankind lives at the bottom of an "ocean of air." (See Fig. 2.) No one is absolutely certain about the depth of this air, but it has been estimated as low as forty miles and as high as two hundred miles. Balloons have gone up to a height of nearly nineteen miles (100,320 feet). We do know that the higher we go, the thinner the air becomes. It is practically impossible for man to ascend into the air more than five or six miles, owing to the fact that the air above that height is so thin that there is not enough to breathe. Naturally, the air at the bottom is more compact because of the vast amount of air above. The air is a great weight lying upon us—14.7 pounds per square inch of surface.

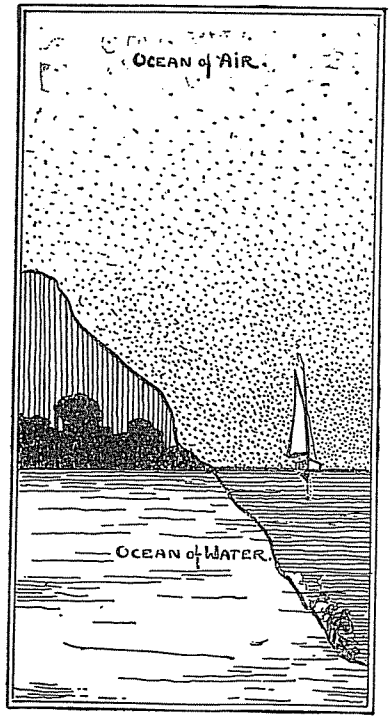

Fig. 2

HOW TO PROVE BY EXPERIMENT THAT AIR HAS WEIGHT

The air-globe is a piece of apparatus for demonstrating that air has weight. (See Fig. 3.) First, the air-globe is weighed and then the air is pumped into it; its stop-cock is closed and the globe is reweighed. It will be found to have gained in weight. This is conclusive that air is matter and that it has weight.

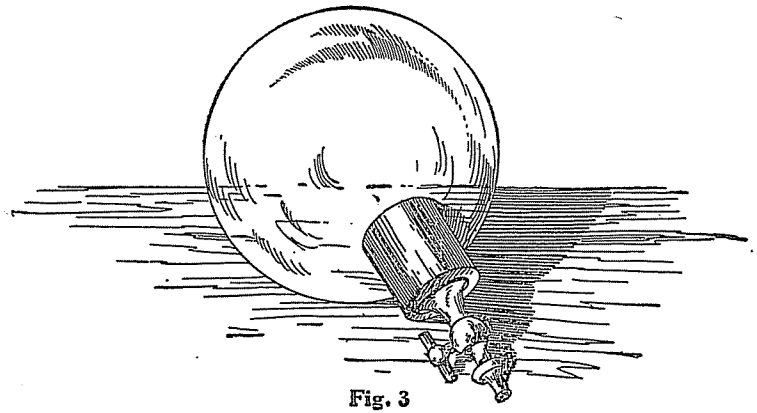

Fig. 3

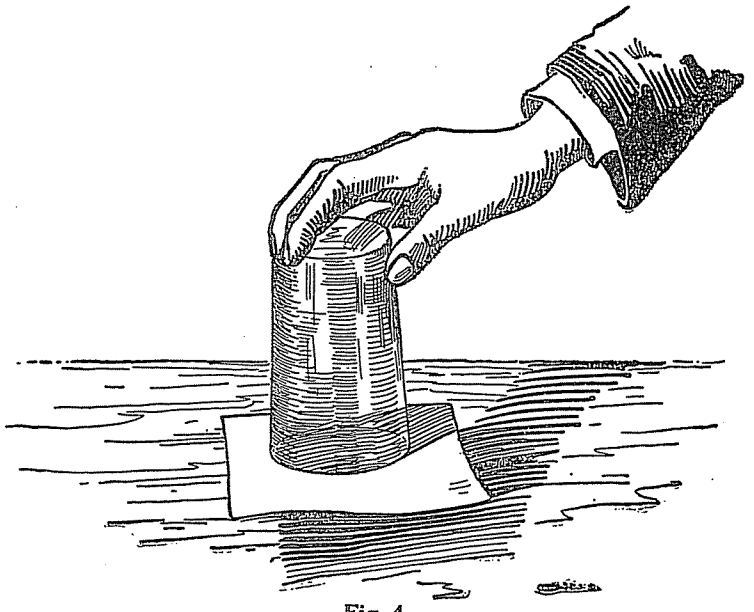

Fig. 4

Of great importance to us in the study is the next fact, that air exerts pressure on everything about us and upon ourselves.

EXPERIMENT NO. 2

A tumbler is filled with water and a piece of paper placed over the top of it. The glass is then inverted, holding the hand over the paper so that none of the water will come out. On taking the hand away, although the glass of water is inverted, the contents do not leave the glass. (See Fig. 4.)

CONCLUSION

It demonstrates that the air is exerting a pressure from below on the paper, which is more than enough to support the weight of the water. The tumbler may be placed in any position and yet the water will stay in. This air pressure is exerted alike from all directions, and this pressure, which is 14.7 pounds to the square inch, is weighed down by the air about it and may be likened very much to ordinary water in that it exerts pressure in all directions.

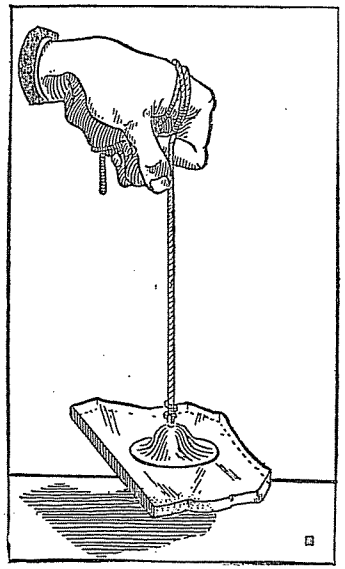

Fig. 5

EXPERIMENT NO. 3

Take an ordinary rubber sucker, such as is used on the end of a dart, and attach it to a string. Force this down on a piece of glass. (See Fig. 5.) The glass can then by lifted by the pressure of the air that holds the rubber to it.

We are indebted to a German experimental philosopher named Otto Von Guericke for knowledge on atmospheric pressure. Guericke is distinguished by his original discoveries of the properties of the air. He was born at Madgeburg in Prussian Saxony, November 20, 1602. He became interested

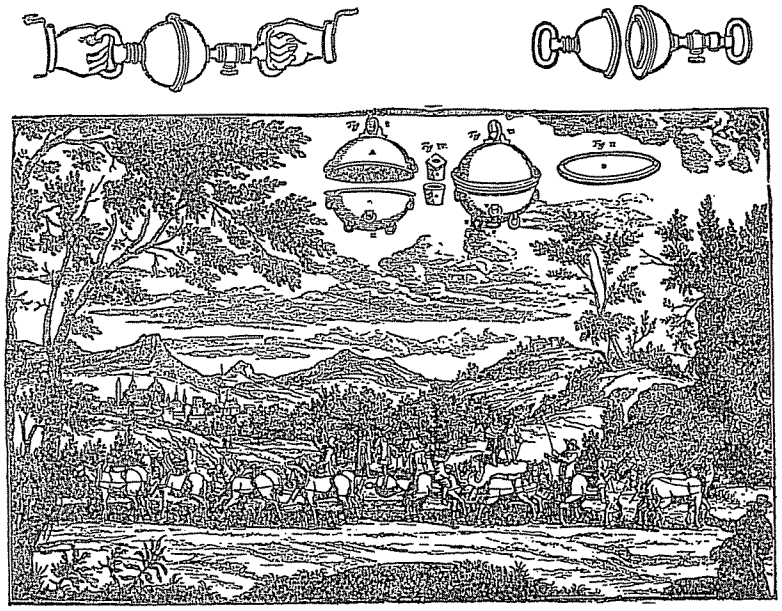

Fig. 6

at an early age in the politics of his city, and in 1627 was elected alderman, and in 1646 Mayor of Madgeburg. While serving in the above capacities, he devoted his leisure to science, especially on the creation of a vacuum and the action of bodies in a vacuum. His first experiments were conducted with a pump on a barrel of water. After drawing off all the water, he still found that air permeated the wood of the barrel, so he substituted a globe of copper and pumped out air also. He thus became the inventor of the air pump and illustrated in a simple but effective way the force of atmospheric pressure.

By placing two hollow hemispheres of copper (see Fig. 6) together, and exhausting the air, he found that fifteen horses pulling one way and fifteen pulling the opposite were unable to pull the hemispheres apart.

He further demonstrated that in a vacuum all bodies fall equally fast, that animals cannot exist therein, or, in fact, living matter. He is also credited with being the inventor of the air balance and a type of weather cock, called the anemoscope. He was interested also in astronomy.

EXPERIMENT NO. 4

This experiment should interest you very much, because it is going to lead up to the subject of weather instruments, and is absolutely essential that you understand the fundamental principles in order to intelligently interpret these instruments. This experiment will explain one of the principles of the barometer.

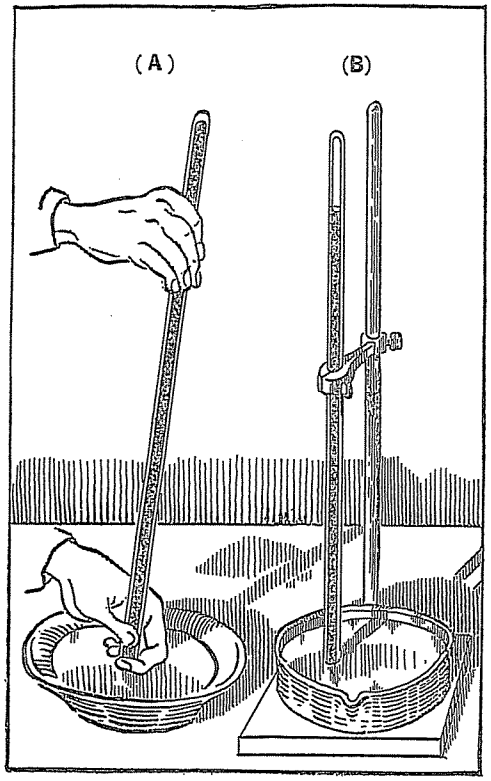

Fig. 7

Take a glass tube thirty-two inches long and one-quarter or one-eighth inch in diameter, and fill it with mercury, care being used to get rid of all the air bubbles. The mercury should be poured in with an eye dropper, one end of the tube being sealed, until filled, and then the finger is placed over the open end. (See Fig. 7A). The tube is inverted and immersed in a reservoir of mercury and clamped to an upright stand.

Immediately the mercury falls to about thirty inches. (See Fig. 7B). Ask yourself what held the mercury up in the tube. Again the answer is that the pressure of the air on the mercury in the reservoir causes it to rise and fall in the tube, as the pressure of the air changes. You will soon learn what causes these changes in the pressure of the air.

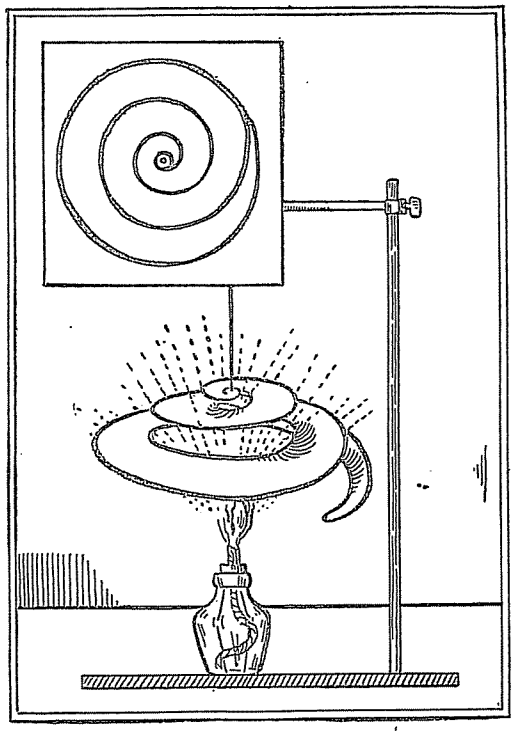

Fig. 8

EXPERIMENT NO. 5

Have you ever asked yourself why it is that the wind blows? Why doesn't it stand still?

Put your hand over a lamp chimney under which the lamp is lighted. You will soon discover that the heat is rising. Four things in connection with this are of great importance:

1. Air has weight.
2. When heated, it rises.
3. Air expands when heated.
4. Warm air will gather and hold more moisture than cold air.

EXPERIMENT NO. 6

Cut a piece of stiff cardboard in a spiral shape. Thread a piece of thread through a pinhole in the center point of the spiral and

fasten this to a support so that it swings freely in the air. (See Fig. 8.) Under this put a little alcohol lamp, or put it over a gas jet or radiator.

WHAT HAPPENS

The cardboard will spin around rapidly. Ask yourself what causes this. It is the force of the hot air rising which caused the spiral cardboard to turn in such an attractive manner.

EXPERIMENT NO. 7

When you are in a warm room, find out which air is the hottest, that in the upper or that in the lower part of the room. This answer you can get by placing the thermometer low down in the room and then putting it up near the ceiling. This is another conclusive proof that hot air rises.

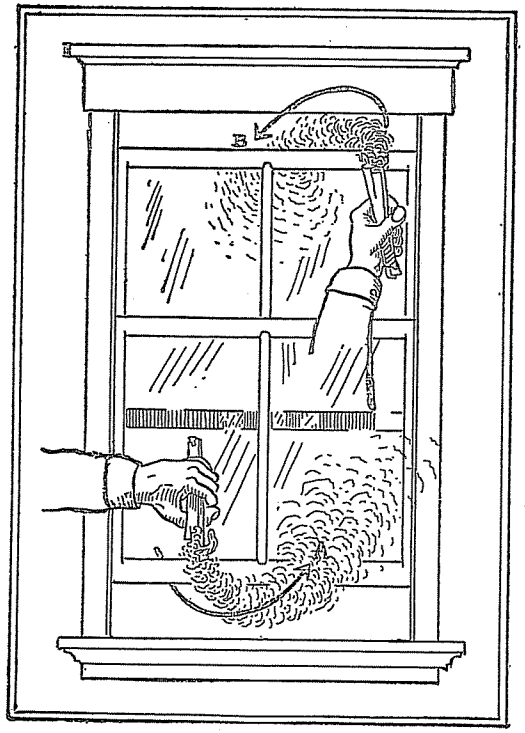

Fig. 9

Another experiment that is quite familiar to all of us is that of opening the windows of a heated room a few inches top and bottom, and holding a lighted match or smoke paper at the bottom, when you will find that it blows the flame or smoke inward. Then put it near the top of the window and it will be drawn out. The same answer is true; the cold air is rushing in from below to take the place of the hot air rising and going out at the top. (See Fig. 9.)

EXPERIMENT NO. 8

This experiment is even more important than the preceding one, and you should by all means do it, for it is going to prove more conclusively than anything else what causes the wind, and in miniature it is a real storm.

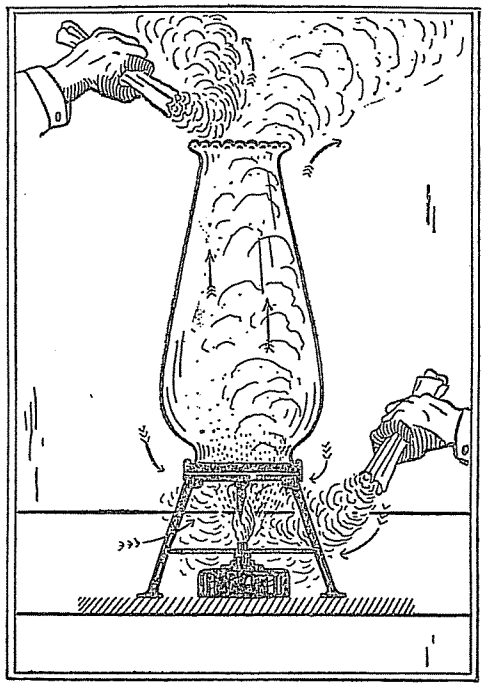

Fig. 10

Place a little alcohol lamp on the table, or a wax candle will do. Over this place an ordinary lamp chimney, lifting it a short distance off the table, and it can be held in position by any little object. (See Fig. 10.) Over the chimney hold some smoke paper. (Smoke paper is nothing more than filter paper, or brown wrapping paper of a soft texture.) From the experiments already visualized to you, you should know what to expect. You will again see that the heated air is rising; it has expanded and become light. Now what becomes of the air that is rising and where does it go? In doing this experiment be careful not to make any unnatural movements that will change the current of wind. Stand perfectly still so that the experiment will be perfect, because you are now producing in miniature a real storm, or demonstrating the cause of wind.