WONDERFUL WATER.

BY SOPHIE B. HERRICK.

Did you ever think what a wonderful thing water is? Fill a glass with it, and look at the light through it. The water is as clear as the glass. You remember in our experiments on matter we found that liquids were made up of millions of particles which lie so closely together that the heaviest weight cannot crowd them much

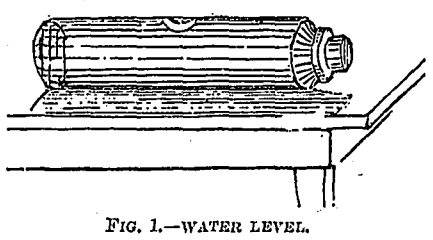

FIG. 1.—WATER LEVEL.

closer, and yet they will slip through your fingers almost as easily as air. You remember too, I hope, how the shot in the glass came to a level somewhat as the water particles did.

Now try to imagine just how it is with the shot in the glass. When they stand level each shot is pushed equally on all its sides by the others, so they keep still, but when you tilt the glass this is not so. They are all pushed more from the high side than from the low side of the glass, and those that can move roll before this pressure, and they keep on rolling till they get to the lowest point they can reach, where the pressure on all sides is equal, and that is a new level. Move the glass, tilting it first one way and then the other, and think about it; you will see how it is. In walking down a steep mountain path have you not often noticed how your foot sets a stone rolling, and how it starts another, till finally hundreds of stones go travelling down the slope? In shot, and still more in stones which are not regular and smooth, some help is needed to start the slide, but it is the pull of gravity that carries it on. With the perfectly smooth particles of water nothing but gravity is needed to set them in motion and to keep them moving.

Perhaps you have been a little confused about what a level is in tilting your glass one way or another. Set your glass of water on a table before you; hold up your plumb-line in front of it: if the top of the water is even with your eye you will find that your line makes with the water-level a straight cross like this +. Now let the bob fall inside, so that it is covered by the water, and look again. No matter which way you tilt your glass, the top of the water and the line make a straight cross with each other. However the glass may be tipped, the water is always level.

Every plumb-line, you know, points to the centre of the earth. Now imagine a hundred or a thousand plumb-lines dropped in a ring around the globe. They would be farther apart at their tops than at their bob ends; they would be set as the spokes of a wheel are around the great earth as a hub. Put ten pins in a row around an orange, letting their points turn toward the centre of the orange, and you will see how this would be. Now the water-level everywhere makes a straight cross with a plumb at that place, so the water on the earth curves as the rind does around the orange. The earth is so very large that we do not see this curve, except on a great sheet of water.

If you are by the sea-shore next summer, watch some large ship as it sails straight away from you. You will see the hull disappear first; it seems to be sinking under the water, but the ship is really slipping over the curve of the earth.

There is a curve in the tops of liquids in small vessels, but this comes from another cause which we will look into later on. This curve is different for different liquids, and has nothing to do with gravity.

It is very necessary to find an exact level sometimes, and this is done by what is called a spirit-level. I want you to make a simple level like this with water (Fig. 1.): take a glass medicine tube corked at one end, or even a homœopathic medicine bottle, the longer the better, however; fill it with water colored a little; cork it, noticing, which is usually the case, that a small bubble of air has been left in the liquid. Lay the tube on its side; if the bubble is in the middle between the two ends, the tube is lying level; if it is not, the end where the bubble is is higher than the other.

The fact that water always tries to come to its own level is very useful in many ways. Our cities are supplied with water by using our knowledge of this. Water is stored in great reservoirs at a higher point than where it will be used. The pipes that carry it can go down underground and up again to the faucets. In the country the water is often pumped up into tanks by wind-mills or by hand, or sometimes by what is called a ram, but the object is to store the water high, so that it will rise wherever it is needed in the pipes.

You know this is true, and use your knowledge every time you tilt a pitcher to pour out water or tip a glass to your lips to drink. To show it plainly, a great many glass vessels, large vases and small tubes, tubes straight and tubes curved, are all joined together at the bottom so that the water can run from one vessel to another; the water does not mind the differences; it stands just as high in one as in the others; it will be at the same height from the table in a tube that goes straight up as in one that curves like a very crooked S.

You have often watched the water shoot up in a beautiful spray from some fountain basin, from your lawn sprinkler, or a hose-pipe. Usually such a jet is caused by water rushing down from a high reservoir.

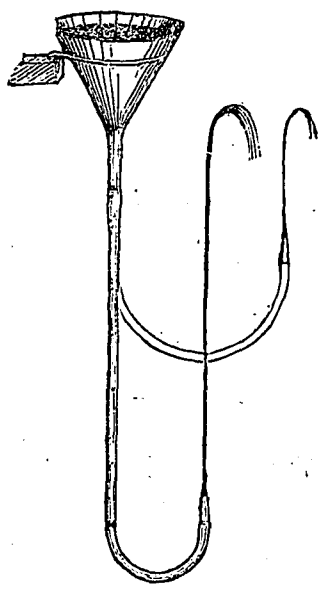

FIG. 2.—FOUNTAIN.

It comes through a pipe which turns upward at the end. The water shoots upward, though it is all the time being pulled back by gravity. I want you to make a little fountain for yourself, so that you can understand (Fig. 2). Take about two feet or more of rubber tubing (you can buy it for about ten cents, and you will need it again, but very likely you can find some about the house;) fit it on the end of a funnel, which you can borrow for the purpose; hang the funnel up; turn up the lower end of the tubing, pinching it between your fingers. Try this where it will do no mischief, in a basin or tub. Now fill the funnel full of water, stopping the turned up end of the tube; when you let it go you will have a little fountain. Now take the funnel in your other hand, and get some one to help you by filling the funnel as it empties; raise and lower the funnel, and you will see the jet of water rise and fall with the movement.

Fig. 3.—Fill a pitcher or bowl of water, and into it dip one end of your rubber tube filled with water, let the other end drop over the edge of the pitcher over a pan; you will find that the water runs up over the edge of the pitcher, and that if the hanging end of the tube is a good deal longer than the dipped end, you can empty the pitcher. This is called a siphon.

Fig. 4.—Pour some water into a thin glass—tumbler or wineglass. Look carefully at the top. It is fairly level, but you see a little irregularity around the edge. Now run your finger around the inner edge of the glass, so as to wet it, and look again. You see, while all the middle part of the water is level, all around the edge it rises up to meet the glass. Into the middle of the water put a small glass tube, not more than a quarter of an inch wide on the outside, and look at it sidewise; you see the water rise around the tube, making a tiny hill of water, there (this tube should be open at both ends). Now look at the inside of it; you see the water standing inside the tube higher than it is outside. The smaller the tube—if the water can get in at all—the higher the water will rise in it. If you have in the house a medicine dropper or a filler for a stylographic pen, take off the little rubber top, and after wetting the tube inside and out dip it a little way in the water; you will see in the fine tube at the end how far the water runs up, and as you dip it farther in and the tube gets wider, how much less the water inside stands above the level of the water outside. This curious quality in water and liquids is called *capillary attraction*, a long word, meaning that they will run up in small tubes, from the Latin word for hair.

By this attraction water will run up through the fine openings in woven stuff. You have noticed, very likely, if you have ever left the corner of a towel in the wash basin and the rest hanging over the edge, how the whole towel became wet; it becomes a sort of siphon. A sponge soaks up water, and the oil is supplied to a lighted lamp in the same way. Liquids do not flow up to any great height by this force. You cannot have the oil in your lamp very far below the flame, or it will not burn well. Sometimes there are little particles of solid matter in the oil, and the tiny openings in the wick become stopped up gradually; then the oil does not flow up easily, and the lamp burns poorly. New wicks will often make the lamps burn as well as they did when they were new. The water is supplied to plants by capillary attraction; the tiny roots suck it up, and the life-giving water runs up from cell to cell throughout the plant. This is not sap I am speaking about now, but water.

Dissolve as much salt as a cupful of water will take up (it will have to stand some time before you can tell how much it will take and still leave the water looking clear.) Color this with a few drops of red or violet ink; then heap high up in the middle of a saucer a teacupful of dry salt; pack it as hard as you can, and pour your colored salt water into the edge of the saucer; you will see the water rise between the grains of salt. The color helps to show it more clearly than if you used clear water.

When anything is lighter than water, it floats; when it is heavier, it sinks; when it is nearly as heavy as water, it sinks till it has pushed out of the way exactly its own weight of water. Salt water is heavier than fresh water. You know that you can float and swim more easily in salt water than in fresh; this is because you do not have to sink so far down to push out of the way your own weight of water. The salt water buoys you up more than the fresh.

Take a glass of fresh water and drop gently into it an egg. It at once sinks to the bottom. Now, spoonful by spoonful, add salt. As it dissolves, the egg begins to rise, till finally it floats on top. This shows that it is not the actual weight of a thing which makes it sink or swim, but its relative weight compared with the liquid it is placed in. The egg weighed the same all the while, but in fresh water it weighed more than the water it pushed out of the way, so it sank. In the salt water it weighed less than the water it pushed out of the way, so it rose.

A boat or block of wood sinks in the water till it has pushed its own weight aside, and there it rests; if you make a little boat and put a stone in it to steady it, you see it sink farther into the water and then stop. The boat at first pushed its own weight of water out of the way; then when you put in the stone it pushed more water—just as much as the weight of the stone—away, and came to rest again.

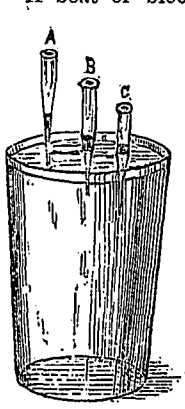

FIG. 4.
CAPILLARITY IN TUBES.

Fig. 5. — Take any common clear glass bottle; pour into it one spoonful of sweet-oil; then pour in a spoonful of water. The water goes down through the oil and lifts that up; the oil is lighter than the water. It makes no difference which you put in first, or how much of either you put in the bottle; the oil will always be on top; it is relatively lighter. This relative weight is called specific gravity. In the figure I have put three liquids—water, oil, and alcohol a little colored—and they stand with a sharp line between each two.

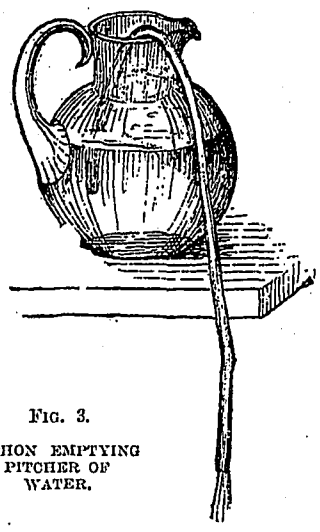

FIG. 3.
SIPHON EMPTYING PITCHER OF WATER.

A chip of wood is heavier than a shot, but its specific gravity, its weight against water of its own size, is less; so the chip floats while the shot sinks.

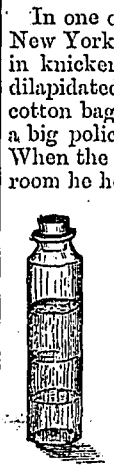

FIG. 5.
VIAL OF DIFFERENT LIQUIDS.

GETTING HIS RIGHTS.

In one of the police courts up town in New York, one morning, a very small boy, in knickerbockers, appeared. He had a dilapidated cap in one hand and a green cotton bag in the other. Behind him came a big policeman with a grin on his face. When the boy found himself in the court-room he hesitated and looked up as if he would like to retreat, but as he half turned and saw the grin on his escort's face he shut his lips tighter and walked up to the desk.

"Please, sir, are you the judge?" he asked, in a voice that had a queer little quiver in it.

"I am, my boy; what can I do for you?" asked the judge, as he looked wonderingly down at the mite before him.

"If you please, sir, I'm Johnny Moore. I am seven years old, and I live in 123d street, near the avenue, and the only good place to play marbles on is in front of a lot near our house, where the ground is smooth; but a butcher on the corner"—and here his voice grew steady and his face flushed—"that hasn't any more right than we have, keeps his waggon standing there, and this morning we were playing marbles there and he drove us away and took six of mine and threw them away off over the fence into the lot; and I went to the police station and they laughed at me, and told me to come here and tell you about it."

The big policeman and the spectators began to laugh boisterously, and the boy trembled so violently with mingled indignation and fright that the marbles in his little green bag rattled together.

The justice, however, rapped sharply on the desk, and quickly brought everybody to dead silence.

"You did perfectly right, my boy," said he, gravely, "to come here and tell me about it. You have as much right to your six marbles as the richest man in the city has to his bank account. If every American citizen had as much regard for rights as you show, there would be far less crime. And you, sir," he added, turning to the big policeman, who now looked as solemn as a funeral, "you go with this little man to that butcher and make him pay for those marbles, or else arrest him and bring him here."

This little boy knew there was a difference between right and wrong. He did not scold nor fight nor swear, but he asked for his rights. This judge knew what was right, too, and taught a good lesson to the bully that wronged the boy, and to the policeman who laughed at him.

AGITATION to secure the observance of Sunday has begun in St. Petersburg. Twelve hundred merchants of the metropolis have declared their readiness to close their places of business on that day.