

SOAP-BUBBLES,

AND THE FORCES WHICH MOULD THEM.

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I do not suppose that there is any one in this room who has not occasionally blown a common soap-bubble, and while admiring the perfection of its form, and the marvelous brilliancy of its colors, wondered how it is that such a magnificent object can be so easily produced.

I hope that none of you are yet tired of playing with bubbles, because, as I hope we shall see soon, there is more in a common bubble than those who have only played with them generally imagine.

The wonder and admiration so beautifully portrayed by Millais in a picture, copies of which, thanks to modern advertising enterprise, some of you may possibly have seen, will, I hope, in no way fall away in consequence of these lectures; I think you will find that it will grow as your knowledge of the subject increases. You may be interested to hear that we are not the only juveniles who have played with bubbles. Ages ago children did the same, and though no mention of this is made by any of the classical authors, we know that they did, because there is an Etruscan vase in the Louvre in Paris of the greatest antiquity, on which children are represented blowing bubbles with a pipe.

It is possible that some of you may like to know why I have chosen soap-bubbles as my subject; if so, I am glad to tell you. Though there are many subjects which might seem to a beginner to be more wonderful, more brilliant, or more exciting, there are few which so directly bear upon the things which we see every day. You cannot pour water from a jug or tea from a tea-pot; you cannot even do anything with a liquid of any kind, without setting in action the forces to which I am about to direct your attention. You cannot then fail to be frequently reminded of what you will hear and see in this room, and what is perhaps most important of all, many of the things I am going to show you are so simple that you will be able without any apparatus to repeat for yourselves the experiments which I have prepared, and this you will find more interesting and instructive than merely listening to me and watching what I do.

There is one more thing I should like to explain, and that is why I am going to show experiments at all. You will at once answer because it would be so dreadfully dull if I didn't. Perhaps it would. But that is not the only reason. I would remind you then that when we want to find out anything that we do not know, there are two ways of proceeding. We may either ask somebody else who does know, or read what the most learned men have written about it, which is a very good plan if anybody happens to be able to answer our question; or else we may adopt the other plan, and by arranging an experiment, try for ourselves. An experiment is a question which we ask of Nature, who is always ready to give a correct answer, provided we ask properly, that is, provided we arrange a proper experiment. An experiment is not a conjuring trick, something simply to make you wonder, nor is it simply shown because it is beautiful, or

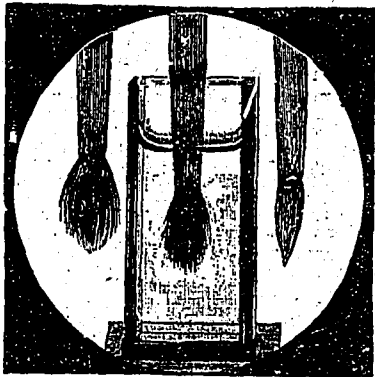


FIG. 1.

because it serves to relieve the monotony of a lecture; if any of the experiments I show are beautiful, or do serve to make these lectures a little less dull, so much the better; but their chief object is to enable you to see for yourselves what the true answers are to questions that I shall ask.

Now I shall begin by performing an ex-

periment which you have all probably tried dozens of times. I have in my hand a common camel's hair brush. If you want to make the hairs cling together and come to a point, you wet it, and then you say the hairs cling together because the brush is wet. Now let us try the experiment; but as you cannot see this brush across the room, I hold it in front of the lantern, and you can see it enlarged upon the screen (Fig. 1, left hand). Now it is dry, and the hairs are separately visible. I am now dipping it in the water, as you can see, and on taking it out, the hairs, as we expected, cling together (Fig. 1, right hand), because they are wet, as we are in the habit of saying. I shall now hold the brush in the water, but there it is evident that the hairs do not cling at all (Fig. 1, middle), and yet they surely are wet now, being actually in the water. It would appear then that the reason which we always give is not exactly correct. This experiment, which requires nothing more than a brush and a glass of water, then shows that the hairs of a brush cling together not only because they are wet, but for some other reason as well which we do not yet know. It also shows that a very common belief as to opening our eyes under water is not founded on fact. It is very commonly said that if you dive into the water with your eyes shut you cannot see properly when you open them under water, because the water gums the eyelashes down over the eyes; and therefore you must dive in with your eyes open if you wish to see under water. Now as a matter of fact this is not the case at all; it makes no difference whether your eyes are open or not when you dive in, you can open them and see just as well either way. In the case of the brush we have seen that water does not cause the hairs to cling together or to anything else when under the water, it is only when taken out that this is the case. The experiment, though it has not explained why the hairs cling together, has at any rate told us that the reason always given is not sufficient.

I shall now try another experiment as simple as the last. I have a pipe from

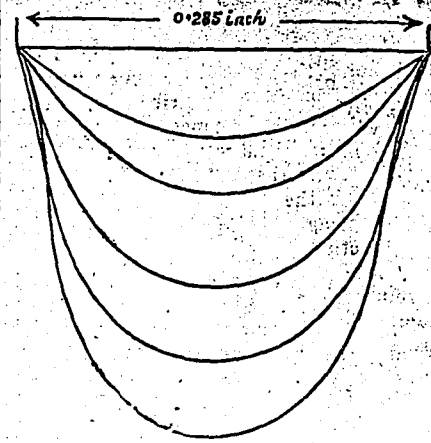


FIG. 2.

which water is very slowly issuing, but it does not fall away continuously; a drop forms which slowly grows until it has attained a certain definite size, and then it suddenly falls away. I want you to notice that every time this happens the drop is always exactly the same size and shape. Now this cannot be mere chance; there must be some reason for the definite size, and shape. Why does the water remain at all? It is heavy and is ready to fall, but it does not fall; it remains clinging until it is a certain size, and then it suddenly breaks away, as if whatever held it was not strong enough to carry a greater weight. Mr. Worthington has carefully drawn on a magnified scale the exact shape of a drop of water of different sizes, and these you now see upon the diagram on the wall (Fig. 2). These diagrams will probably suggest the idea that the water is hanging suspended in an elastic bag, and that the bag breaks or is torn away when there is too great a weight for it to carry. It is true there is no bag at all really, but yet the drops take a shape which suggests an elastic bag. To show you that this is no fancy, I have supported by a tripod a large ring of wood over which a thin sheet of india-rubber has been stretched, and now on allowing water to pour in from this pipe you will see the rubber slowly stretching

under the increasing weight, and, what I especially want you to notice, it always assumes a form like those in the diagram. As the weight of water increases the bag stretches, and now that there is about a painful of water in it, it is getting to a state which indicates that it cannot last much longer; it is like the water-drop just before it falls away, and now suddenly it changes its shape (Fig. 3) and it would immediately tear itself away if it were not for the fact that india-rubber does not stretch indefinitely; after a time it gets tight and will withstand a greater pull without giving way. You therefore see

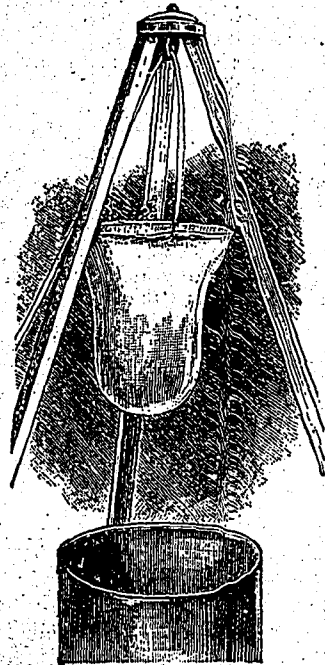


FIG. 3.

the great drop now permanently hanging which is almost exactly the same in shape as the water-drop at the point of rupture. I shall now let the water run out by means of a syphon, and then the drop slowly contracts again. Now in this case we clearly have a heavy liquid in an elastic bag, whereas in the drop of water we have the same liquid but no bag that is visible. As the two drops behave in almost exactly the same way, we should naturally be led to expect that their form and movements are due to the same cause, and that the small water-drop has something holding it together like the india-rubber you now see.

(To be Continued.)

A HINT TO STAMP BEGINNERS.

Bottled mucilage should never be used to put stamps into an album because it discolors the stamps. Stamps should not be spoiled by gumming them down solid to the book. Fix them by hinges made of gummed paper. These can be bought at any dealer's, or you can make them yourself. To do this you require four ounces gum-arabic. This you can purchase at any drug store. Dissolve it in water till it becomes a gummy substance. Get a thin piece of paper linen, if possible, and also a sponge, and give the paper a thin coat. After it is dry it can be cut any size you wish.

A collection mounted in this way can be moved without damage to either stamps or album. Portraits of rulers, flags, and coats of arms beautify an album very much.

It does not pay to buy a cheap album, because in these there is such a poor quality of paper that a stamp cannot be removed without tearing the paper, thus spoiling the whole page. Many collectors make this mistake, and regret that they had not purchased a good one at the start.—*Edgar D. C. Jones, in Harper's Young People.*

HELPLESSNESS.

When an afternoon full of games has left the nursery in great disorder, Bessie and Gertrude have one very last game to play, called 'Helpfulness.'

Bessie invented it. On separate slips of paper are written the names of the principal things in the room,—floor, chairs, rug, bookcase, bureau, closets, sofa, corners, tables, window-sills and desk,—the slips of paper shuffled about, backs up.

Each person 'playing' draws one in turn till all are taken, putting in order that part of the room or piece of furniture named, and when the game is done, behold the room neat and fresh again.—*Companion.*

THE OLD STONE BASIN.

In the heart of the busy city,
In the scorching noontide heat,
A sound of bubbling water
Falls on the din of the street.

It falls in an old stone basin,
And over the cool, wet brink
The heads of the thirsty horses
Each moment are stretched to drink.

And peeping between the crowding heads,
As the horses come and go,
The 'Gift of Three Little Sisters'
Is read on the stone below.

Ah! beasts are not taught letters;
They know no alphabet;
And never a horse in all these years
Has read the words; and yet

I think that each thirsty creature
Who stops to drink by the way,
His thanks, in his own dumb fashion,
To the sisters small must pay.

Years have gone by since busy hands
Wrought at the basin's stone—
The kindly little sisters
Are all to women grown.

I do not know their home or fate,
Or the name they bear to men,
But the sweetness of that precious deed
Is just as fresh as then.

And all life long, and after life,
They must the happier be
For the cup of water poured by them
When they were children three.

—Susan Coolidge.

TURKISH HOSPITALITY.

The Rev. J. A. Ainslie, a missionary to Mosul, writes:—'On landing at Alexandretta, our passports were called for. I attended the baggage to the "Customs," while the ladies went to the khan. As some keys were missing, I went to the khan for them, and there left my knapsack, which contained my Bible.

'Returning to the "Customs," I opened my trunk and valise for inspection. The officers hunted out every book and printed piece of paper, taking them all out to send to Aleppo for examination. All our Bibles (except the one left at the khan,) old railway guides and time tables, catalogues of the British Museum, old papers, as well as children's picture books, with the books we were reading by the way, all of them were taken. I took our agent afterward, and tried to get some of them back, but could do nothing. I learned afterward that they treated us no worse than others. When Dr. Fuller came, a few days later, they took away from him every book they could find, and even searched his person. They also proposed taking away his letters of credit and some letters in his pocket.'

AT A LATER DATE.

'Our goods are allowed free of duty, but our agent at Alexandretta sends word here that he paid on our boxes something like sixty or seventy dollars duty. I do not understand why such a charge has been made. He also writes that our boxes of books had been sent to Aleppo for examination. I expected that, and can only hope that they may get through.

'He also writes me that there is a printing press in one of our boxes, and that printing presses are forbidden in Turkey. I suppose he refers to my type-writer. He has sent to our Consular agent in Aleppo, asking if it may come into the country. Meanwhile my poor little type-writer waits at the Custom House, a dangerous instrument as the Turks regard it. We hear nothing of the books taken from us at Alexandretta.'

Well well, well! What sort of government must it be which stands in such fear of treason that it considers it needful to confiscate even the baby picture books! Poor lonely babies, with never a picture of Puss, Wag, or Mrs. Biddy left them! The thing would be, indeed, laughable were it not so aggravating.—*Presbyterian Observer.*