and beast upon the frozen snow. The moment they struck the ground they parted company. James was left bruised and bleeding by the road-side, while the lynx flew onwards as fast as the horse could gallop, one end of the halter being fastened to the cutter and the other tight about the animal's neck, which was therefore dragged helplessly along, its body bounding over the hard rough road, and was soon out of sight and hearing.

The poor horse broke loose from the shattered sleigh before he reached Conklingville, and made his way to the town, to the consternation of the ostlers at the inn, who, with Mr. Talbot, were still sitting up to receive the belated traveller. Of course two or three men at once set out with lanterns on a search for James, and it was not long before they found both him and the sleigh, and the lynx choked and beaten to death. James had his wounds dressed, and before many days was sufficiently recovered to return to Muskoka. He had the torn skin of the "painter" dried, and carried it off to his home as a trophy, and they all agreed in saying that if ever he had wished to meet with a desperate adventure he certainly had enjoyed one now. Great was the distress expressed by his young companions, and Mrs. Ashburton was exceedingly glad that her own boy was not yet obliged to run such desperate risks. But Alfred wished he had been there, as he thought that, being two to one, they might have enjoyed the adventure with little harm to any but the "painter."

Summer came at last, and with the first brilliant days a letter arrived having a black border. It was heavy news to the two brothers, and Mr. Talbot left them to their grief for some few days. He was a kindly man and felt for their sorrow. Suddenly, one morning he came in, and said—

"My lads, put up whatever you may want in a valise, and be ready to start with me in an hour's time. We are off for Toronto, to wait there for Rosa and the little one, and bring them back with us. The change will do us good, and you must both try to give her as bright and cheerful a welcome as you possibly can. She will want her spirits to be kept up, you see, and so we must do our best."

Next morning at five o'clock they left in the Rosseau steamer.

The two poor travellers from England arrived at Toronto very shortly, and very tender was the meeting of the long parted brothers and sisters. They mutually thought each other very much grown, but at first they were silent and shed some tears, and it was not till after the first day was over that they began to find out how much each had to say.

Mr. Talbot told Rosa that she was to be the mistress of his house—an interest to her, and a great source of comfort to all.

Then, as Mr. Talbot wished to give them all as much recreation as possible, he arranged to take them to see the wonderful and far-famed Falls of Niagara before proceeding homewards.

*(To be continued.)*

## HOW TO MAKE TOY BALLOONS.

*By the Author of "The Telephone, and how to Make One," &c.*

PERHAPS there is hardly anything which excites greater interest than a balloon ascent. It has just that element of danger connected with it which somehow or other invests it with a charm which other things of a safer nature can never claim. The balloon ascents which take place yearly—to the number of several hundred in this country alone—will attest their popularity; and the fact that we seldom hear of any accident in connection with them is a very pleasing one.

In a former paper in this Magazine we learnt the reason *why* a balloon rose in the air; in other words, the matter was treated theoretically. The object of the present article is to put that theory into practice by learning how to make a balloon.

I hope that my readers will not jump to the conclusion that I am going to instruct them to make a machine capable of raising them to the clouds, for I intend no such thing. In the first place, their parents might object to losing them; and in the next place, the readers of LITTLE FOLKS would be suddenly very much diminished. My purpose is simply to give a few plain directions which will enable any one to make a small balloon, which will, under favourable conditions, be capable of travelling several miles, but which will be far too small to carry up a youngster, unless he be

only as big as my thumb; and as such small folk are limited to fairy tales, it would be rather difficult to find a passenger.

We have already learnt, in the paper before mentioned, that there are two kinds of balloons—one being filled with heated air, called a "*fire*-balloon," and the other with hydrogen, called a "*gas*-balloon." We must also remember that both these kinds of balloons rise in the air because their contents are much lighter than the surrounding atmosphere. Heat swells out the air to double or treble its former size, and it immediately begins to rise in the denser air around it. If you will ask some tall friend of yours to lift you up in a sitting-room where the gas has been burning for some time, you will be surprised to find how warm a place the ceiling is, and you will be glad to get down again as quickly as possible. Now if hot air has this tendency to reach the highest place, it is very clear that if we can shut it up in a very light skin it will pull up that skin with it. It is how to make this skin in the most easy and suitable form that constitutes the art of balloon construction. I shall also show you how to make small gas-balloons, which—except in a few details of manufacture, the reason of which you will quickly understand—are much the same as fire-balloons. The gas, in its character of lightness, bears the same relation to cold air as does air in a heated state.

Fig. 1.

We will commence with making a fire-balloon. Let us think over, first of all, the object to be attained. We are at present aware of one simple fact—that is, that heated air will rise. Our endeavour must be to shut up a certain mass of this heated air in some very light envelope, so that that covering will rise too. This will constitute our first balloon. Paper at once suggests itself as being the most suitable material for this envelope (*all* envelopes are made of paper you will say when you read this); and, of course, we must procure the thinnest possible. Five-pound notes would furnish a beautiful material, but would be rather expensive; and, luckily, common silver or tissue paper will answer the purpose admirably.

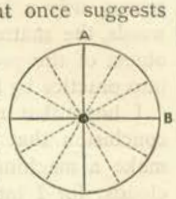


Fig. 2.

The best shape for a balloon is that of a sphere—like the earth itself. You know that many things assume this shape naturally, from a drop of rain-water to one of those immense planets which appear like brilliant stars in the sky. It is usual to speak of a balloon as being pear-shaped; but a pear is, after all, merely a round thing with a slight prolongation where the stem is. Look at the accompanying figure (Fig. 1), and you will see how the balloon resembles a pear—because it has a neck attached, through which the gas is admitted. In fire-balloons this neck is greatly widened, in order that there may be no risk of the flame which is used to heat the air in the balloon burning up the machine itself.

Our first business is to make what is called a pattern; but before we do this we must think over the shape that the pattern should be. With the help of an orange and a sharp knife we shall soon learn more about the construction of a balloon than we could from many pages of description; and the same operation will teach us of what shape the pattern should be.

Suppose that Fig. 2 represents the top of the orange as we look down upon it, the dark spot in the centre representing the place where the stem once joined it to the branch on which it grew. Now with the knife cut through the rind of the fruit the two lines marked A and B respectively, so that these two cuts will traverse the orange all round. It is clear that if we were now to strip the fruit the rind would fall into four equal parts. But

Fig. 3.

if, instead of doing this, we also cut through the *dotted* lines, we shall have twelve pieces of rind of equal size. While we are eating the juicy portion of the orange we can observe the shape of these twelve pieces of rind, and also notice that if we fit them roughly together we shall have a very good imitation of a whole orange—indeed, we shall have something after the shape of a balloon too. Can we do better, then, than adopt the shape of one of these pieces of orange-peel to build up a structure which must resemble it so much?

One such piece of orange is now lying on the table before me. It measures four inches long, and three-quarters of an inch across in the middle. If we double this four inches we shall get eight inches as the upright circumference, or measure round the orange over the top and bottom. And if we multiply the three-quarters of an inch by twelve, in order to take into account all the pieces of peel removed, it will give nine inches as the circumference of the fruit horizontally. So you see the orange is not perfectly round—indeed, we can see that without any measurement whatever. But you know that the measurements I have given are

not intended to prove anything about the orange, but merely to make you understand how easy it is to determine by a simple calculation the proper width for the gores of a balloon of any given size.

Fig. 4.

The cutting out of a brown paper pattern for these gores need not be a difficult matter, if the directions which I am now about to give are carefully attended to. As both sides of this pattern will correspond in outline, the easiest way to cut it out will be to double the paper throughout its length, and cut the two sides in one operation. A reference to the diagram at Fig. 3, will explain how the right curve can be obtained. The shaded portion represents the doubled brown paper, with its folded edge lowermost. This paper can be tacked on the floor of an uncarpeted room, with the folded edge upon the join between two of the floor boards. At a certain distance from the paper, according to the size of the balloon, a point will be reached where a nail must be driven into the floor. Over this nail a piece of string must be looped, with a pencil attached to its other end. The nail, in short, will be the centre of a circle of which we only require a very small portion. The pencil will mark this portion, which will constitute the correct curve for our balloon pattern.

The pattern being made (Fig. 4), there will be no difficulty in cutting the gores out of tissue paper. It must be noticed that in fire-balloons they will be cut off at the point marked * in Fig. 3; but in gas-balloons, where the mouth is not required to be wide or open, they will be prolonged to the full extent of the pattern. For the same reason the fire-balloon will be slightly wider in diameter than the gas-balloon, the former requiring fourteen gores, while the latter will want but twelve.

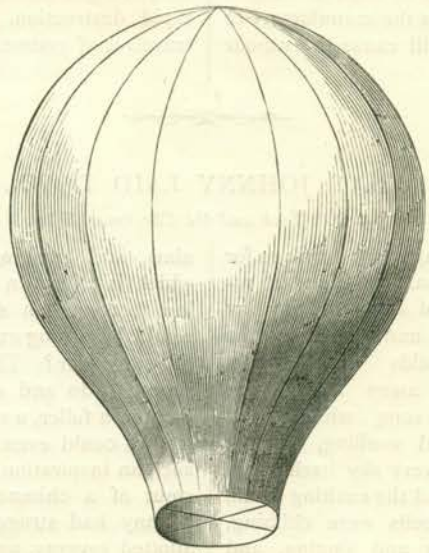

Fig. 5.

Of course, the first operation will be to join up the sheets of paper in such a way as to allow of their being cut to the best advantage and without waste. The joins must be made with glue and paste mixed in equal proportions, and used hot. The nature of the join can be readily understood by taking two sheets of paper, laying them upon the table, and allowing the edge of the lower one to project half an inch beyond the upper one. This projecting edge must be pasted, and neatly bent over the upper sheet. The two sheets can then be set aside, and another pair joined in the same manner until all are finished. These last directions refer to the horizontal joins in the paper out of which the gores are to be cut; but the gores themselves must be joined together in precisely the same manner. They should all be folded down the centre, as was the pattern from which they were cut, and laid one upon the other upon the table, with the folded edge *from* the operator. The first gore he must turn bodily over so that its folded edge will meet the folds of all the others. Then he must unfold the next one, and turn its edge over to within half an inch of the first one. This half inch will be the edge to receive the paste, and must then be pulled over and smoothed down. The same operation must be gone over and over again, until all the gores are firmly united together. The work may then be put away until the paste has thoroughly dried.

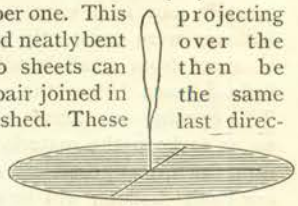

Fig. 6.

Whatever be our care in joining these gores together, we shall find, when the paste is dry enough for us to handle the balloon, that its top represents rather an unfinished structure, because the ends of the gores do not properly come together. This fault is quickly remedied by cutting off all the ragged points, leaving a round orifice in the top of the machine. Of course, it would not do to leave matters in this state, for all the heated air would quickly run out of the balloon, and it would refuse to rise. We must therefore close up this hole by what is called the "crown." This consists of two pieces of paper, round in form, and larger than the hole which they have to cover. One piece is pasted inside, and the other outside, the balloon. The inner one is put into position first, and before the upper one is placed upon it a crossed piece of thread (see Fig. 6), with a loop attached, should be affixed to it. This crosspiece will strengthen the crown, and the loop, which must emerge through a small hole in the upper

paper, will serve as a convenient means of handling the finished balloon.

The mouth, or lower opening of the machine, must be our next care. At the time when fire-balloons were constantly used the heated air was obtained from small bundles of straw burnt in a little furnace below the opening of the balloon. This opening was therefore furnished with a hoop, so as to keep the material of the balloon as far from the fire as possible. Although the furnace in our model balloon will be of a much more simple character, we shall also require a hoop to keep the mouth of the balloon open. This can be of fine wire, or what is better, because lighter, a slip of cane. The bottom edge of the balloon should be neatly pasted over this hoop, and the machine is complete. (See Fig. 5).

When the time comes for the balloon to ascend, we must put two bits of binding wire across the hoop, with a piece of dry sponge as big as a large walnut in the centre. The balloon can be inflated by means of a piece of flaming paper, when some methylated spirits of wine must be poured over the sponge, a light applied to it, and up the machine will go. I need hardly say that a day must be chosen for the operation when there is absolutely no wind, or the balloon will catch fire. We need not be so particular in the case of gas-balloons, for they are quite independent of such a danger. But more care must be taken in the manufacture of the latter, for the least hole will cause the vapour to escape.

I have already pointed out that in cutting the gores of a gas-balloon they must be brought to a point, but we shall still have sufficient orifice left in which to insert an india-rubber pipe from the gas supply. Before, however, the gas is called into requisition the balloon must be made gas proof—that is, all the little pores in the paper must be filled up by applying to the balloon, by means of a piece of flannel, a coating of boiled linseed oil. This coating will take some hours to dry, and while drying the balloon should be hung so that it will not touch anything. I must also caution my readers that any surplus oil will drop from it, so that the operation should be conducted in some outhouse or cellar, where a little grease is of no great moment.

Common house gas can be used to fill the balloon, and this business must be left to older hands, for gas is not a thing to be played with. This gas is much heavier than pure hydrogen, so the latter is much more serviceable for the balloonist. Any manual of chemistry will give directions how it can be made.

I have myself made balloons which I have watched in the sky until they have appeared no larger than minute specks among the clouds. After a balloon is successfully launched it will probably travel for a great many miles, and in the case of a gas-balloon, where no danger exists of its rapid destruction, the probable distance of its travels is of course greatly increased.

T. C. H.

## WHAT JOHNNY LAID DOWN.

*By the Author of "Jack and the Christmas Echoes," &c. &c.*

"WE ought to lay down our lives for the brethren." A glory, a radiance, as of an untold joy, lay on the sea, and rioted over the sloping fields and downs, stretching away and away. Oh! the song which went circling and swelling, echoing up to the very sky itself, from the laughing sea, and the exulting earth, where the clover-bells were chiming, bees humming, larks soaring and singing, and human hearts throbbing out we know not what of aspirations. All spoke of a gathering up, a retaining, a holding, an enjoying, and nothing of a laying down, a resigning of that mysterious treasure called life. "We ought to lay down our lives for the brethren;" life, with its many hopes, aims, and graspings after some sovereign good, which is to crown and glorify our existence; to lay it down on such a morning as this, who would be strong enough for such a deed of noble self-surrender? The inspiration comes to us at times, to do and dare, like the prompting of a greater, a fuller, a more complete life than that we feel we could even lay down, if need were. And such an inspiration came to Johnny Green, a little smut of a chimney-sweep boy, and an orphan. Johnny had struggled through ten years of his allotted seventy, and was even now in appearance, so to speak, a blot on God's fair earth. Ah! how can we tell who are blots and who are even jewels and gems, as we plod along, every one in his own path, our eyes dazzled with the sunshine of our happy homes?

But to tell our tale. Johnny Green was not