The young man's book of amusement

Halifax, 1848

Optics

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OPTICS.

Singular Experiment.

FIX, at the height of the eye, on a dark ground, a small round piece of white paper, and a little lower, at the distance of two feet to the right, fix up another, of about three inches in diameter; then place yourself opposite to the first piece of paper, and, having shut the left eye, retire backwards, keeping your eye still fixed on the first object; when you are at the distance of nine or ten feet, the second will entirely disappear from your sight.

Singular Effect on the Visual Organs.

Affix to a dark wall a round piece of paper, an inch or two in diameter; and a little lower, at the distance of two feet on each side, make two marks; then place yourself directly opposite to the paper, and hold the end of your finger before your face in such a manner, that when the right eye is open, it shall conceal the mark on the left; and when the left eye is open, the mark on the right: if you then look with both eyes

to the end of your finger, the paper, which is not at all concealed by it from either of your eyes, will nevertheless disappear.

Portable Camera Obscura.

The camera obscura is a most amusing optical toy. Fig. 3, is a box constructed for this purpose. A magnifying-glass is placed in the wooden tube *a*, and the object is thrown upon the angular mirror *b*, A complete picture of the most extensive view may thus be obtained in the space of a few inches, and the box may be carried in the pocket of the observer.

The Thaumatrope—an amusing Toy.

The optical principle on which this machine is constructed, is the duration of an impression on the eye, after the object producing it has been withdrawn, and which is said to last about a second.

The cards are each suspended by a bobbin at either side. There is a *part* of a figure or object represented on one side of the card, and the remainder on the other. For example: we have the head of a watchman on the obverse of one, and the empty watch-box on the reverse; by twirling the bobbins, and consequently spinning the card, the head and box fit together and we see a complete guardian of the night.

Then there are some choice *jeux d'esprit*. There is on the obverse of one card a thing like a well worn bundle of birch, but by twirling the bobbins we produce a shower of fresh leaves, and these leaves falling upon that bundle produce the striking likeness of a *tree*.

Optical Experiment.

If a box be formed with a small aperture at one of its sides, and three candles be made to revolve on a piece of wood in the centre, the light opposite the axis will be visible on a semi-transparent screen, placed to receive its image. The other two candles will also have their flames depicted on the screen, at similar distances on each side. This experiment serves to shew the exceeding minuteness of the rays which emanate from the candles; for, if they were not exceedingly small, they would not pass each other without destroying the perfection of the image.

This experiment may be made very amusing by placing a piece of glass, with a ship or any other object painted on it, in the aperture; and when the candles are parallel to the screen, three images may be seen; but, on making them revolve through a quarter of a circle, only one image will be visible on the screen. By increasing the number of candles, the ships will be increased in an equal ratio, and a single ship, by turning the row of candles, will be converted into an entire fleet.

The Artificial Landscape.

Procure a box (See Fig. 4.) of about a foot long, eight inches wide, and six inches high; or any other dimensions you please; so they do not greatly vary from these proportions. At each of its opposite ends on the inside of this box, place a piece of looking-glass that shall exactly fit: but at that end where the sight hole A is, scrape the quicksilver off the glass, through which the eye can view the objects.

Cover the box with gauze, over which place a piece of transparent glass, which is to be well fastened in. Let there be two grooves at each of the places C, D, E, F, to receive two printed scenes as follows: on two pieces of pasteboard, let there be skilfully painted, on both sides, any subject you think proper, as woods, bowers, gardens, houses, &c. and on two other boards, the same subjects on one side only, and cut out all the white parts: observe also, that there ought to be in one of them some object relative to the subject placed at A, that the mirror placed at B may not reflect the hole on the opposite side.

The boards painted on both sides are to slide in the grooves C, D, E, F, and those painted on one side are to be placed against the opposite mirrors A and B; then cover the box with its transparent top. This box should be placed in a strong light, to have a good effect.

When it is viewed through the sight hole, it will present an unlimited prospect of rural scenery, gra-

dually loosing itself in obscurity; and be found well worth the pains bestowed on its construction.

Pleasing Optical Appearance.

If a soap-bubble be blown up, and set under a glass, so that the motion of the air may not affect it, as the water glides down the sides, and the top grows thinner, several colours will successively appear at the top, and spread themselves from thence in rings down the sides of the bubble, till they vanish in the same order in which they appeared. At length a black spot appears at the top, and spreads till the bubble bursts.

The thinnest substance ever observed is the aqueous film of the soap bubble previous to bursting; yet it is capable of reflecting a faint image of a candle, or the sun. Hence its thickness must correspond with what Sir Isaac Newton calls the *beginning of black*, which appears in water at the thickness of the seven hundred and fifty thousandth part of an inch.

Another.

A convex and concave lens, of nearly the same curvature, being pressed closely together, exhibit rings of colours about the points where they touch. Between the colours there are dark rings, and, when

the glasses are very much compressed, the central spot is dark.

The Kaleidoscope.

The principal parts of the Kaleidoscope are two reflecting planes made of glass or metal, or any other reflecting substance, ground perfectly flat, and highly polished. These reflectors may have any magnitude, but in general, they should be from four or five to ten or twelve inches long, their greatest breadth being about an inch when the length is six inches, and increasing in proportion as the length increases. When these two plates are put together at an angle of 60, or the sixth part of a circle, and the eye placed at the narrow end, it will observe the opening multiplied six times, and arranged round the centre.

Changes of the Kaleidoscope.

The following curious calculation has been made of the number of changes this instrument will admit.

Supposing the instrument to contain twenty small pieces of glass, &c. and that you make ten changes in each minute, it will take the inconceivable space of 462,880,899,576 years, and 360 days to go through the immense variety of changes it is capable of producing. Or, if you take only twelve small pieces and make ten changes in each minute, it will then

require 33,264 days, or 91 years and 49 days, to exhaust its variations.

On the selection of objects for the Kaleidoscope.

Although the Kaleidoscope is capable of creating beautiful forms from the most ugly and shapeless objects, yet the combinations which it presents, when obtained from certain forms and colours, are so superior to those which it produces from others, that no idea can be formed of the power and effects of the instrument, unless the objects are judiciously selected.

The objects which give the finest outlines by inversion, are those which have a curvilineal form, such as circles, ellipses, looped curves like the figure 8, curves like the figure 3, and the letter S; spirals and other forms, such as squares, rectangles, and triangles, may be applied with advantage. Glass, both spun and twisted, and of all colours and shades of colours, should be formed into the preceding shapes; and when these are mixed with pieces of flat-coloured glass, blue vitriol, native sulphur, yellow orpiment, differently coloured fluids enclosed and moving in small vessels of glass, &c., they will make the finest transparent objects for the Kaleidoscope. When the objects are to be laid upon a mirror plate, fragments of opaquely-coloured glass should be added to the transparent fragments, along with pieces of brass wire, of coloured foils, and grains of spelter. In selecting transparent objects, the greatest care must be taken to reject frag-

ments of opaque glass, and dark colours that do not transmit much light, and all pieces of spun glass or coloured plates should be as thin as possible.

Solar Microscope.

Make a round hole in the window-shutter, about three inches in diameter, and place it in a glass lens of about twelve inches focal distance. To the inside of the hole adapt a tube, having at a small distance from the lens, a slit, capable of receiving one or two very thin plates of glass, to which the object to be viewed must be affixed by means of a little gum water, exceedingly transparent. Into this tube fit another, furnished at its anterior extremity with a lens half an inch focal distance. Place a mirror before the hole of the window shutter on the outside, in such a manner as to throw the light of the sun into the tube, and you will have a solar magic lantern. The method of employing it is as follows: having darkened the room, and by means of the mirror reflected the sun's rays on the glasses in a direction parallel to the axis, place some small object between the two moveable plates of glass, or affix it to one of them with very transparent gum water, and bring it exactly into the axis of the tube; if the moveable tube be then pushed in or drawn out till the object be a little beyond the focus, it will be seen painted very distinctly on a card or piece of white paper, held at a proper distance; and will appear to be greatly magnified. A small

insect will appear a large animal, or a hair as big as a walking-stick; the eels in vinegar, or flour paste will look like small serpents.

The Portable Diorama,

Is a most instructive and delightful production of art, capable of affording endless and refined amusement to all ranks and ages. A neat box contains a series of transparent views, abbey ruins, sea-pieces, various landscapes, &c., which fit into a slight wooden frame. There is also a number of atmospheric, and other effects produced by having similar transparencies painted in clouds, with a rainbow, with a moon, or merely plain pieces of silk, of crimson, yellow, &c.; any of which being placed behind the first-mentioned views, (and occasionally combined with a moveable gauze curtain,) impart to them all the changes of morning, evening, dawn, sunset, moonlight, &c., &c., and gratify the spectator with the most charming and picturesque changes. Objects seem to take novel positions, and the entire scenes, have all their relations varied from tempest to profound repose. It is really difficult to imagine seeing them, how materials so unimposing in their forms should be made to convey such gratification to the mind.

To draw, easily and correctly, a Landscape, or any other object without being obliged to observe the Rules of Perspective, and without the Aid of the Camera Obscura.

Procure a box of pasteboard, A, B, C, D, (Fig, 5) of about a foot and a half long, and made in the shape of a truncated pyramid, whose base B, D, F, G, is eight inches wide, and six inches high. Fix to the other end of it a tube of four or five inches long, and which you can draw out from the box more or less. Line the inside of the box with black paper, and place it on a leg or stand of wood, H, and on which it may be elevated or depressed by the hinge I.

Take a small frame of wood, and divide it at every inch by lines of black silk drawn across it, forming forty-eight equal parts ; divide these into still smaller equal parts, by lines of finer silk ; the different thicknesses of silk serving to distinguish more readily the corresponding divisions : fix this frame at the end of B D, as the base of the pyramid.

Provide a drawing paper, divided into the same number of parts as in the frame, by lines, lightly drawn in pencil. It is not material of what size these divisions are ; that will depend entirely on the size you propose to draw the objects by this instrument.

Place this instrument opposite a landscape, or any other object that you want to draw, and fix the leg firmly on, or in the ground, that it may not shake ; then turning it to the side you choose, raise or incline it, and put the tube further in or out, till you have

gained an advantageous view of the object you intend to draw.

Place your eye E, by the instrument which you have adjusted to the height of your eye, and looking through the tube, carefully observe all that is contained in each division of the frame, and transpose it to the corresponding division in your paper: and if you have the least knowledge in painting, or even drawing, you will make a very pleasing picture, and one in which all the objects will appear in the most exact proportion.

By the same method you may draw all sorts of objects, as architecture, views, &c. and even human figures, if they remain some time in the same attitude, and are at a proper distance from the instrument.

Illuminated Prospects.

Provide yourself with some of those prints that are commonly used in optical machines, printed on very thin white paper; taking care to make choice of such as have the greatest effect from the manner in which the objects are placed in perspective. Place one of these on the borders of a frame, and paint it carefully with the most lively colours, making use of none that are terrestrial. Observe to retouch those parts several times where the engraving is strongest, then cut off the upper part or sky, and fix that on another frame. When you colour a print, place it before you, against a piece of glass, in a position nearly erect, that it may

be enlightened by the sun. You may also colour both sides of the print.

The prints being thus prepared place them in a box, A, B, C, D, (Figs. 6, 7.) the opening to which, E, F, G, H, should be a little less than the print. Cover this opening with a glass, and paint all the space between that and the prints, which should be about two or three inches, black. The frame that contains the sky should be about an inch behind the other. In the back part of this box, which is behind the prints, and which may be about four inches deep, place four or five small candlesticks to hold wax lights, and cover that part entirely with tin, that it may be the more luminous.

When the print is placed between the wax lights and the opening in the front of the box, and there is no other light in the room, the effect will be highly pleasing; especially if the lights are at a sufficient distance from each other, and not too strong, that they may not occasion any blots in the print. Those prints that represent the rising or setting of the sun will have a very picturesque appearance. Such as represent conflagrations have also a striking effect.

There should be two grooves for the print next the glass, that you may insert a second subject before you draw away the first: and that the lights in the back of the box may not be discovered.

You must not, thinking to make the print more transparent, cover it with varnish; for that will prevent the gradation of the colours from being visible. The frame should enter the side of the box by a groove, that a variety of subjects may be introduced.

Optical Illusion.

Suspend a ring freely to a string, on a level with the eye, but in such a manner that you cannot see the hole of the ring. Take a stick about a yard long, and fasten another smaller stick crosswise to one end of it. Then shut one eye and try to thread the ring with the small stick, and you will scarcely ever succeed; but use both eyes, and you will do it at the first attempt.

ELECTRICITY.

ELECTRICITY is found to be of two kinds, which are generally distinguished by the appellations of *positive* and *negative*, or their equivalents *plus* and *minus*.

Positive and negative electricity may be readily distinguished by the taste, on making the electric current pass, by means of a point, on to the tongue. The taste of the positive electricity is acid, that of the negative electricity is more caustic, and, as it were, alkaline.

The two electricities may also be distinguished in the following manner: if a pointed conductor, such as a needle, be presented to an excited glass tube in the dark, a globular speck of light will be observed