The young man's book of amusement

Halifax, 1848

Hydrostatics and Hydraulics

	HOURS.	MIN.
The fifth	0 ..	30
The sixth	0 ..	47
The seventh	0 ..	27
The eighth	0 ..	30
The ninth	0 ..	22
The tenth	0 ..	21

The above experiments elicit the following conclusions :—

1. That an animal will live longer in vital than in atmospheric air.—2. That, one animal can live in air, in which another has died.—3. That, independently of air, some respect must be had to the constitution of the animal; for the sixth lived 47 minutes, the fifth only thirty.—4. That there is either an absorption of air, or the production of a new kind of air which is absorbed by the water as it rises.

HYDROSTATICS AND HYDRAULICS.

The Pressure of Water.

The pressure of water may be known to every one who will only take the trouble to look at the cock of a water-butt when turned; if the tub or cistern be full, the water runs with much greater velocity through the cock, and a vessel will be filled from it in a shorter time than when it is only half full, although the cock, in both cases, is equally replete with the fluid during the time the vessel is filling. From this also is understood, how a hole or leak, near the keel of a ship, admits the water much quicker, and with greater violence, than one of the same size near what the mariners call the water's edge.

The power of Water.

Let a strong small iron tube of twenty feet in height be inserted into the bung-hole of a cask, and the aperture round so closed, that it shall be water-tight; pour water into the cask till it is full through the pipe: also continue filling the pipe till the cask bursts, which will be when the water is within a foot of the top of the tube. In this experiment the water on bursting the vessel, will fly about with considerable violence.

Expansive Force of Freezing Water.

Colonel E. Williams, of the Royal Artillery, when at Quebec, made many experiments on the expansive force of freezing water. He filled all sizes of iron bomb-shells with water, then plugged the fuze-hole close up, and exposed them to the strong freezing air of the winter in that climate, sometimes driving in the iron plugs as hard as possible with a sledge hammer; and yet, though they weighed near three pounds, they were always forced out by a sudden expansion of the water in the act of freezing, like a ball impelled by gunpowder, sometimes to the distance of between 400 and 500 feet; and when the plugs were screwed in, or furnished with hooks or barbs, by which to lay hold of the inside of the shell, so that they could not possibly be forced out, in that case the shell always split in two, though its thickness of metal was about an inch and three quarters. It is further remarkable, that through the circular rack, round about the shells where they burst, there stood out a thin film, or sheet of ice like a fin; and in the cases where the plugs were projected by freezing water, there suddenly issued from the fuze-hole a bolt of ice of the same diameter, and stood over it sometimes to the height of eight inches and a half. Hence, we need not be surprised that excessive frost should cause the ice to split rocks and other solid substances.

To make Water ascend between two Pieces of Glass, and form a regular Figure.

Procure two pieces of glass, about six inches square, join any two of their sides, and separate the opposite sides with a piece of wax, so that their surfaces may form an angle of about two or three degrees; immerse this apparatus about an inch in a basin of water, and the water will rise between the plates, and form a beautiful geometrical figure, called an hyperbola.

How to raise Water several Feet above its ordinary Level.

The syphon is employed by distillers and others, for the purpose of emptying casks, and it may be advantageously used to decant wine, as the wine may be raised from the most turbid ground without mixing with the sediment beneath. To make this instrument, it is merely necessary to bend a glass tube by the application of heat; and if a second tube be attached, and the air sucked out, the fluid will continue to flow as long as any water remains in the upper vessel.

How to Work a Pump without Manual Labour.

Captain Leslie, of the American vessel the George and Susan, invented, in his voyage from North America to Stockholm, the following simple method of keeping the ship's pumps at work, when the sea runs high, and when the crew are not sufficient, or are already fatigued:—About ten or twelve feet above the pump, he fixed a spar, or small mast, one end of which projected overboard, while the other was fastened as a lever to the machinery of the pump. To the end which projected overboard, was suspended a water butt, half full. By this simple contrivance, every coming wave, as it raised the water butt sunk with it, and raised the piston again; thus, without the aid of the crew, the ship was cleared of water in four hours' time.

Exposition of a Paradox.

It is a vulgar paradox, "that when water is boiling in a vessel the bottom is cool, but the moment it ceases to boil the bottom becomes hotter." The whole of the paradox appears to be founded on an error of sense. When a person applies his finger to the vessel, though he applies it for a considerable time, it is not heated more than he can endure, for the blood in the course of its circulation loses some of its heat before it arrives at the extremities: and till the blood in the extremities is heated to the same degree with that of the heart, we feel no pain from burning; but as soon us this is effected, the least degree of heat becomes painful. When the finger is first applied to the bottom of the vessel, after it is taken off the fire, the heat is endured for these reasons. When the boiling ceases, it is natural to take the same finger (for, having dirtied one, people seldom choose to take another), and that finger being already heated almost as much as it could bear, now finds the heat at the bottom of the vessel exquisitely painful.

To shew that Water is contained in the Atmosphere in the driest Weather.

Take a tea-spoonful of dry muriate of lime, or acetate of potash, or sub-carbonate of potash, spread it in a saucer, and suffer it to be exposed to the open air for a few days, the dry salt will thus be rendered completely liquid, by the watery vapour which always exists in the atmosphere.

Imitative Water Spout.

The phenomenon of the water spout may be illustrated by a very easy experiment.

In a stiff paper card make a hole just large enough to insert a goose quill; after cutting the quill off square at both ends, lay the card upon the mouth of a wine-glass filled with water to within the fifth or sixth part of an inch from the lower orifice of the quill; then applying the mouth to the upper part, draw the air out of the quill, and in one draught of the breath draw in about a spoonful of water; and this you may repeat, the water remaining as before. The water will not ascend to the mouth in a stream, which it would do if the quill reached to it, but broken, and confusedly mixed with the air which ascends with it. The usual phenomena of waterspouts are exactly agreeable to this theory.

To render visible the opposite Currents in which Fluids are thrown, while they change their Temperature.

Fill a common eight-ounce phial, or cylindrical glass jar, about two inches or more in diameter, and five or six inches long, with cold water, and diffuse through it a small portion of pulverised amber: let the phial of water be immersed into a tumbler, containing hot water: this being done, two currents, going in different directions, will be observed in the inner vessel, the one ascending, the other descending; that is to say, the minute particles of amber, which were diffused through the fluid, and were at rest before the heat was applied to the water in the inner vessel, will be seen in motion; those particles that are situated towards the sides of the glass, or which are the nearest to the source of heat, will move upwards, whilst those that are in the centre move downwards: and thus two distinct currents are formed in opposite directions. These currents gradually diminish in velocity; and when the water in the inner vessel has acquired the same temperature as that in the outer one, the particles of amber will again be brought to a state of rest.

If the position of the two glass vessels be reversed, namely, if the glass containing hot water be immersed in a vessel containing cold water, the motion of the currents will be also reversed: the particles next to the sides of the glass are thrown into currents, directed downwards, whilst the particles in the centre form a current upwards. The equilibrium of these two currents will also be restored, when the equalization of temperature of the water within, and that without, has been effected.

To render the experiment more decisive, the lower part of the water may be coloured by tincture of cabbage, or red ink, leaving the upper part uncoloured. If heat be then applied to the bottom part of the glass, the coloured part of the water gradually ascends, and uniformly tinges the whole fluid.

Mode of Attracting Water.

Hang a quantity of wool, tied loosely together, down into a deep well, about five or six yards from the water; leave it in that position through the night, and its weight will, in the morning, be greater by one-fifth than it was the evening before. The additional weight will have been caused by the accession of particles of water from the humid atmosphere.

To find the Specific Gravity of Solids.

Hang the substance by a hair to one end of the beam, weigh it first accurately in air, setting down with a pen the weight in grains and decimal parts; then place under it a glass vessel, pouring water in till it be filled to within three quarters of an inch from the brim. And immerge the body in the water, suspended by the horse hair to the hook at the bottom of the water scale. In this proceeding, we must take care that the same weights that balanced the body in air be in the opposite scale, and likewise the proper *balance water weights*, and that no air-bubble adhere to any part of the substance in the water, which will render it apparently lighter. The *opposite* scale to that which contains the substance will now greatly preponderate; weights should therefore be put into the scale till the equilibrium be restored.

The pen will now finish the operation. Divide the weight in air by the loss in water; that is, divide the number of grains in the large scale by those in the small one, and the quotient will shew the specific gravity, or how many times heavier the substance that was weighed is than water. If the weight in the small scale be *subtracted* from that in the other, it will shew the *respective gravity* of the weighed substance, or the weight with which it will be evenly balanced in water.

Table of Specific Gravities.

Refined gold	19.640
English guinea	18.888
Mercury	14.019

Lead	11.344
Refined silver	11.019
Copper from Sweden	8.843
Hammered brass	8.349
Cast brass	8.100
Elastic steel	7.820
Soft steel	7.738
Iron	7.645
Pure tin	7.471
A diamond	3.400
Island crystal	2.720
Rock crystal	2.650
Common glass	2.620
Fine Marble	2.704
Stone of mean gravity,	2.500
Brick	2.000
Nitre	1.000
Alabaster	1.875
Dry ivory	1.825
Brimstone	1.800
Alum	1.714
Oil of vitriol	1.700
Honey	1.450
Gum arabic	1.375
Aquafortis	1 300
Pitch	1.150
Human blood	1.126
Amber	1.040
Milk	1.030
Urine	1.030
Dry box-wood	1.030
Sea-water	1.030

Common water	1.000
Bees-wax	0.955
Linseed oil	0.932
Oil, olive	0.913
Spirit of turpentine	0.874
Rect. spirit of wine	0.856
Cork	0.240
Air	0.00¼

Experiment with the Syphon.

If one leg of a syphon be immersed in a vessel of water, and the other leg hang out of it, in such manner that the lower end be below the surface of the water; on opening both the orifices at the same instant, the water will be found to flow out at the lower orifice, till its surface has sunk down to the orifice of the leg in the water.

Tantalus's Cup.

Several entertaining deceptions have been practised by means of the Syphon. One of the most usual is that of Tantalus's Cup, but the explanation of which is not necessary here, as its operation will be evident at the first view. It is usual to conceal the syphon in the figure of a man representing Tantalus; and when the cup is filled with water as high as his mouth, that is a little above the curve of the syphon, the latter beginning to act, at length discharges the whole contents of the cup. Similar deceptions have been practised by concealing the syphon in the handle of a drinking vessel.

ACCOUSTICS.

The Talking Busts.

PROCURE two busts of plaster of Paris, place them on pedestals on the opposite sides of a room. Let a thin tube, of an inch diameter, pass from the ear of one head through the pedestal, under the floor, and go up to the mouth of the other; taking care that the end of the tube that is next the ear of the one head, be considerably larger than that end which comes to the mouth of the other.

Now when a person speaks quite low into the ear of one bust, the sound is reverberated through the length of the tube, and will be distinctly heard by any one placing his ear to the mouth of the other. It is not necessary that the tube should come to the lips of the bust. If there be two tubes, one going to the ear, and the other to the mouth of each head,