The young man's book of amusement

Halifax, 1848

Acoustics

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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,

two persons may converse together by whispers, without the knowledge of any person who may stand in the middle of the room.

Sound.

The French academicians made, in 1738, some experiments for measuring the velocity of sound: the Board of Longitude renewed them in the month of June last, with all possible precision, when they found that the velocity of sound in the air at the temperature of 55 degrees, Fahrenheit, differs very little from 1044 feet per second.

Music of Light.

Dr. Buchanan, of Kentucky, conceives that he has found some affinity between the different rays of light, as presented in a rainbow, and the notes of music. Following up this theory, real or imaginary, he proposes to furnish a concert for the eye; that is, that the eye should experience the same pleasure by an harmonic rise and fall of the different rays of light, as the ear does by the accordance of sweet sounds. How far this plan is practicable, is a thing resting on experiment. Something analagous to this may have given birth to the fable of Memnon's harp, which was said to have uttered delightful strains of melody when touched by the solar rays.

Speaking Automata.

The Egyptian idols are of this class. Memnon, the head of Friar Bacon, and the statue of Albert Magnus. Darwin, in his Temple of Nature, lays down a process for forming an automatical speech. Bacon, in his Natural History, experiment 139, notes the trembling of water resembles the letter *h*; the quenching of hot things, the letter *z*; the sound of strings, the letters *n* and *o*; and the jerking of a switch the letter *g*.

Ventriloquism.

It seems that the factitious voice produced by a ventriloquist, does not (as the etymology of the word imparts) proceed from the belly, but is formed in the inner parts of the mouth and throat. The art does not depend on a particular structure or organization of these parts, but may be acquired by almost any person ardently desirous of attaining it, and determined to persevere in repeated trials. A sudden change of direction in sound, our knowledge of which does not depend on the impulse of the ear, but on other facts, will be perceived, when the original communication is interrupted, provided there be a sensible echo. This will be perceived by any person who walks along a valley intercepted with buildings, at a time that a peal of bells is ringing; for the sound of the bells, instead of arriving constantly at the ears

of the person in its true direction, is frequently reflected in a short time from two or three different places, and the steeple appears, in the hearer's judgment, to perform the part of an expert ventriloquist, that which is occasioned by accident in the case of the bells, being performed by art in the case of the ventriloquist. The following curious facts, tending to illustrate a professional display of the art, may now be introduced :—The audience were arranged in two opposite lines, corresponding to the two sides of a long narrow room. The benches on which they were seated, reached from one end of the place to the middle of it, the other part remaining unoccupied. The feats exhibited by him were the three following : —First, he made his voice come from behind his audience, but it never seemed to proceed from any part of the wall near the heads of the people present ; on the contrary, it was always heard resembling the voice of a child, who seemed to be under the benches. He stood during the time of speaking in a stooping posture, having his mouth turned towards the place from which the sound issued : so that the line, joining his lips and the reflecting object, did not approach the ears of the company. Second, advancing into the vacant part of the room, and turning his back to the audience, he made a variety of noises, that seemed to proceed from an open cupboard which stood directly before him, at the distance of two or three yards. Third, he placed an inverted glass cup on the hands of his hearers, and then imitated the cries of a child confined in it. His method of doing it was this : the upper part of the hearer's arm laid close

along his side; then the part below the elbow was kept in a horizontal position, with the hand turned downwards, which was done by the operator himself. After taking these preparatory steps, the man bent his body forwards in a situation which presented the profile of his face nearly to the front of his hearers, whilst his mouth pointed to the cup; in which posture he copied the voice of a confined child so completely, that three positions of the glass were easily distinguished by as many different tones, viz. when he pressed the mouth of the cup close against the palm, when one edge of it was elevated, and when the vessel was held near the hand, but did not touch it. The second and third instances of ventriloquism afford strong proofs, that this delusive talent is nothing more than the art of substituting an echo for the primary sound; for, besides the change perceivable in the direction of the voice, it was found to be blended with a variety of secondary sounds; such as we know by experience are produced, as often as a noise of any kind issues from a cavity. The responses of many of the ancient oracles were delivered by persons possessing this quality, so very capable of being applied to the purpose of priestcraft and delusion.

On Sounds excited in Hydrogen Gas.

As the intensity of sound is diminished by the rarefaction of the medium in which it is produced, it

might have been expected that the sound in hydrogen gas would be feebler than when produced in atmospheric air in similar circumstances. Mr. Leslie, however, has found the difference to be actually much greater. Having placed within a receiver of an air-pump, a small piece of clock-work, by which a bell was struck every half minute, the air was rarefied, and after the re-action had been carried the length of one hundred times, hydrogen gas was introduced. The sound, however, so far from being augmented, was, at least, as feeble as in atmospheric air of that extreme rarity, and decidedly much feebler than when formed in air of its own density, or rarefied ten times. Mr. Leslie likewise observed the very curious fact, that the mixture of hydrogen gas with atmospheric air, has a predominant influence in blunting or stifling sound. When one half of the volume of atmospheric air is extracted, and hydrogen gas admitted to fill up the vacant space, the sound will now become scarcely audible: an effect which he ascribes to a want of intimate combination between the gases, which causes the pulsatory impressions to be dissipated before the sound is originally formed.

Sonorous Properties of different Gases.

By causing a small tin pipe, brought into contact with a cock in the neck of a bell glass, to be blown by gas contained in a bladder applied to the external aperture of the cock, it will be observed, that the

sound is a semitone lower with azotic and oxygen gas than with atmospheric air, a third lower with carbonic acid gas, and nearly the same with nitrous gas; but with oxygen gas, from nine to eleven tones higher than the air that surrounds us. A mixture of azote and oxygen, in the same proportion as in the atmospheric air, will give the same tone as the latter; but when the mixture of these gases is not uniform, the sounds are totally discordant.

When a plate of glass is agitated by means of a bow, if some dust is strewed over the glass, the former will appear to have arranged itself symmetrically, after the plate ceases to emit sound. Under the like circumstances, the figures are always the same, their changes depending only upon the gravity or acuteness of the tone.

Musical Figures resulting from Sounds.

Cover the mouth of a wide glass, having a footstalk with a thin sheet of membrane, or vegetable paper, over which scatter a layer of fine sand. The vibrations excited in the air by the sound of a musical instrument, held within a few inches of the membrane, will cause the sand on its surface to form regular lines and figures with astonishing celerity, which vary with the sound produced, affecting a particular mode of division, according to the number of vibrations.

Gigantic Meterological Æolian Harp.

Captain Haas, of Basle, has designated by these an apparatus which emits of itself a variety of sounds during a change of weather. Since the year 1787, he had stretched above his garden fifteen iron wires, three hundred and twenty feet long, and at the distance of about two inches from one another: the largest wire was two lines in diameter, the smallest one line, and those of intermediate size one line and a half. They were situated towards the south, and are inclined 20 or 30 degs. to the horizon, being stretched by means of rollers, properly arranged for the purpose. Whenever the weather changes, these wires sound with such loudness that it is impossible to go on with a concert in the house. The sounds sometimes resemble the hissing noise of water rapid in ebullition, sometimes that of an harmonicon, and sometimes that of a distant chime, or an organ.

The inventor of this curious apparatus is Mr. Ventau, provost of Burkli, not far from Basle. He sometimes shot at a mark from his window, and in order that he might not go to the mark at each shot, he attached to it a long iron wire to draw it to him at pleasure. He remarked more than once that the wire sounded exactly an octave; and he found that every iron wire, stretched in a direction parallel to the sounds, emitted this tone at every change of the weather.

A brass wire did not produce any sound, nor did an iron wire when it was stretched from east to west.

M. Dobereiner, of Jena, conceives that the phenomenon now described, is the effect of an electro-magnetic action; and he proposes to try if the brass wire would not sound when it communicates at its extremity with an energetic electrometer.

To Make an Æolian Harp.

This instrument may be made by almost any carpenter: it consists of a long narrow box of very thin deal, about five or six inches deep, with a circle in the middle of the upper side, of an inch and a half in diameter, in which are to be drilled small holes. On this side, seven, ten, or more strings, of very fine gut, are stretched over bridges at each end, like the bridges of a fiddle, and screwed up or relaxed with screw pins. The strings must be all tuned to one and the same note, and the instrument be placed in some current of air, where the wind can pass over its strings with freedom. A window, of which the width is exactly equal to the length of the harp, with the sash just raised to give the air admission, is a proper situation. When the air blows upon these strings, with different degrees of force, it will excite different tones of sound; sometimes the blast brings out all the tones in full concert, and sometimes it sinks them to the softest murmurs.

Beautiful Figures in Sand, &c. produced by Sound.

It has long been known that the agitations produced in the air by a sounding body may be sufficient to excite a second body placed even at a great distance from the first, provided, however, that both be capable of producing exactly the same number of vibrations in the same time.

Dr. Savarb has been making experiments with stretched membranes, which at the same time that the thickness are very inconsiderable, present large surfaces to the air, which puts them in motion. He took, for example, a circular piece of thin paper, or gold-beaters' skin, about ten inches in diameter, and carefully stretched it by its circumference upon the edge of a large glass vase; on strewing the surface, placed horizontally, with fine and dry sand, and bringing a plate of glass in vibration within the distance of nine or ten inches, and parallel with the surface, the membrane entered into motion, and the sand assumed figures, which were sometimes perfectly regular, and which often formed themselves with so much rapidity, that his eye had scarcely time to perceive the circumstances which accompanied the transformation of the light layer of sand into a greater or less number of quiescent lines. Various figures were thus obtained—stars with four, six, ten, or more radiations, circles, &c. When the plate instead of being parallel, was placed perpendicularly to one of the diameters of the surface, the sand formed itself into a system of quiescent lines, which ge-

nerally were parallel with one another: one of these lines passed always through the centre of the membrane, and was contained in the plane which passed through the face of the plate; the direction of the motion consequently continually changed with the direction of the vibrating plate. If instead of holding the place in the direction of perpendicular to that of the surface, it was inclined; at every degree of inclination the phenomena obtained were different, and the lines traced by the sand continually modified themselves differently, although the number of vibrations remained the same.*

Acoustical Alphabet.

By varying the order of arrangement, the whole alphabet may readily be rung on three bells; and these being formed into sentences by short pauses between each word, will fully serve for distant conversation. For musical instruments, it is merely changing keys for bells, and the same purpose may

* The tones of the flute, trumpet, musical glasses, &c. or of the voice, produced the same results as a vibrating plate. When the tones were successively varied, for example, when a very slow air was performed on the flute, at about nine or ten inches distance from the membrane, the sand was agitated, and traced lines, the combinations of which incessantly varied with the sound produced.—Stringed instruments were not so well calculated to produce these effects. These experiments were varied in a number of ways, by employing membranes, of which the dimensions, nature, and tension, as well as form, were different: they always, however, presented analogous results.

be answered without the trouble of forming changes upon so small a number of fixed tones. A table is subjoined, by the use of which a combination of three bells is made to express the whole alphabet:

A	is represented by	111	O	is represented by	222
B	..	112	P	..	223
C	..	113	Q	..	231
D	..	121	R	..	232
E	..	122	S	..	233
F	..	123	T	..	311
G	..	131	V	..	312
H	..	132	U	..	313
I	..	133	W	..	321
K	..	211	X	..	322
L	..	212	Y	..	323
M	..	213	Z	..	333
N	..	221			

Musical Flame.

Musical tones are produced by the combustion of hydrogen gas in tubes of different diameters.

The following Experiment is taken from the Century of Inventions of the Marquis of Worcester, and professes to be, "How to make a Brazen or Stone Head in the midst of a great Field, or Garden, so artificially and natural, that though

a Man speak ever so softly, and even whisper into the ear thereof, it will presently open its Mouth and resolve the question in French, Latin, Welsh, Irish, or English, in good terms, uttering it out of its Mouth, and then shut it until the next question is asked."

Let a concave mirror of about two feet diameter, be placed in a perpendicular direction. The focus of this mirror may be fifteen or eighteen inches from its surface. At the distance of about five or six feet let there be a partition, in which there is an opening, equal to the size of the mirror: against this opening must be placed a picture, painted in water-colours, on a thin cloth, that the sound may easily pass through it. Behind the partition, at the distance of two or three feet, place another mirror, of the same size as the former, and let it be diametrically opposite to it. Place the figure of a man seated on a pedestal, with his ear exactly in the focus of the first mirror: his lower jaw must be made to open by a wire, and shut by a spring; and there may be another wire to move the eyes; these wires must pass through the figure, go under the floor, and come up behind the partition. A person, properly instructed, should be placed behind the partition near the mirror. Then propose to any one to speak softly to the statue, by putting his mouth to the ear of it, assuring him that it will answer instantly. You then give the signal to the person behind the partition, who, by placing his ear to the focus of the mirror, will hear distinctly what the other said; and, moving

the jaw and eyes of the statue by the wires, will return an answer directly; which will, in like manner be distinctly heard by the first speaker.

Singular Experiment with a Barrel Organ.

In a large case, such as is used for dials and spring-clocks, the front of which, or at least the lower part of it, must be of glass, covered on the inside with gauze, let there be placed a barrel organ, which when wound up is prevented from playing, by a catch that takes a toothed wheel at the end of the barrel. To one end of this catch there must be joined a wire, at the end of which there is a flat circle of cork, of the same dimension with the inside of a glass tube, in which it is to rise and fall. This tube must communicate with a reservoir that goes across the front part of the bottom of the case, which is to be filled with spirits, such as is used in thermometers, but not coloured, that it may be the better concealed by the gauze. This case being placed in the sun, the spirits will be rarefied by the heat; and rising in the tube, will lift up the catch or trigger, and set the organ in play: which it will continue to do as long as it is kept in the sun; for the spirits cannot run out of the tube, that part of the catch, to which the circle is fixed, being prevented from rising beyond a certain point, by a check placed over it. When the machine is placed against the side of a room on which the sun shines strong, it may constantly re-

main in the same place, it inclosed in a second case, made of thick wood, and placed at a little distance from the other. When you want it to perform, it will only be necessary to throw open the door of the outer case, and expose it to the sun.—But if the machine be moveable, it will perform in all seasons by being placed before the fire; and in winter, it will more readily stop when removed into the cold.

The following interesting Account of the Echo will be, no doubt, amusing to the reader.

An echo is a reflection of sound striking against some object, as an image is reflected in a glass: but it has been disputed what are the proper qualities in a body for thus reflecting sounds. It is in general known, that caverns, grottos, mountains, and ruined buildings, return this image of sound. There is a very extraordinary echo, at a ruined fortress near Louvain, in Flanders. If a person sung, he only heard his own voice, without any repetition: on the contrary, those who stood at some distance, heard the echo but not the voice; but then they heard it with surprising variations, sometimes louder, sometimes softer, now more near, then more distant. There is an account in the Memoirs of the French Academy, of a similar echo near Rouen. As every point against which the pulses of sound strike, becomes the centre of a new series of pulses, and sound describes equal distances in equal times; therefore, when any sound

is propagated from a centre, and its pulses strike against a variety of obstacles, if the sum of the right lines drawn from that point to each of the obstacles, and from each obstacle to a second point be equal, then will the latter be a point in which the echo will be heard. Hence all the points of the obstacles which produce an echo, must lie in the surface of the oblong sphæroid, generated by the revolution of the elipse round its major axis.

But though the first reduced pulses may produce no echo, both on account of their being too few in number, and too rapid in their return to the ear; yet it is evident, that the reflecting surface may be so formed, as that the pulses which come to the ear after two reflections or more, may, after having described 127 feet or more, arrive at the ear in sufficient numbers, and also so nearly at the same instant, as to produce an echo, though the distance of the reflecting surface from the ear be less than the limit of echoes. This is confirmed by a singular echo in a grotto on the banks of the little brook, called the Dinan, about two miles from Castlecomber, in the county of Kilkenny. As you enter the cave, and, continue speaking loud, no return of the voice is perceived; but, on your arriving at a certain point, which is not above fourteen or fifteen feet from the reflecting surface, a very distinct echo is heard.