THE GATHERER.

Electrical Railways for New York.

Dr. Siemens' electrical train has been running constantly every day at the Brussels Exhibition during the summer. It shoots under bridges, and whisks round curves, at the speed of a fast-trotting horse. The engine is no bigger than a tea-box, and draws three carriages, each carrying six passengers, sitting back to back, after the manner of an Irish jaunting car. A larger experiment in electrical conveyance is, however, about to be made in America, with a view to test the applicability of the system to the New York elevated railways. Eight miles of the Camden and Amboy Railway in New Jersey are now being fitted up for the electric locomotive, and if the experiment answers as well as is expected, the steam locomotives of the city lines in New York will be dispensed with. Perhaps the lead of New York will be in time followed on our London underground lines, to the great sanitary advantage of the passengers.

Chicken Cholera.

M. Pasteur, the distinguished French biologist, has discovered that the malady known as chicken cholera is due to a microscopic organism in the virus of the disease, and, further, that the nature of the virus may be so modified that, like the inoculated virus of cow-pox, it will produce only a mild disorder, which, nevertheless, will protect the animal from a more malignant attack. M. Pasteur also regards chicken cholera as a connecting link between those virulent diseases affecting man and other animals which spring from a virus containing living germs, and those which are due to a virus in which no life has been detected. The sanitary value of his discovery is probably very great, for it holds out the promise of a time when science shall have made it possible to ward off the more virulent forms of infectious diseases by the inoculation of a mild virus.

The Resonator.

To increase the volume of the voice in singing or speaking to a large audience, Signor Alberto B. Bach has introduced a little instrument termed the Resonator. The roof of the mouth acts, as is well known, as a sounding-board for the voice, and Signor Bach's invention consists of an artificial palate, which is added to the real one, so as to augment its power. The instrument consists of a gold plate fitted to the roof of the mouth close above the upper teeth, much in the same way as the gold frame of a set of false teeth is fitted, and having another gold plate of convex contour attached to it. A hollow resonance cavity is thus formed, which, while it is said not to interfere with the distinctness of the articulation, at least after a moderate amount of practice, certainly increases the volume of sound producible by the vocalist. Of course, as Signor Bach remarked, in a lecture to the Royal Academy of Music, the instrument will not give a good voice to any one who does not already possess one by nature, nor will it eradicate any faults in singing; but, properly employed, it will increase the volume of sound without any extra effort on the singer's part.

A Marine Electric Light.

There have been so many collisions lately, either between ocean steamers and icebergs during the night, or between ships during intense fogs, that any appliances for preventing them in future will be welcomed by the sea-going public. Perhaps the best preventative is the use of a powerful electric light placed in the fore-part of the ship, and so manipulated as to send a penetrative beam in any direction ahead. In this country Dr. Siemens has devised such an apparatus, and in America another has been recently invented by Mr. Maxim. This consists of a dynamo-electric generator and a special lamp, for projecting the electric light. The generator resembles that of Dr. Siemens, and need not therefore be described. The projector consists of a flat brass box, turning freely on trunnions in all directions, and enclosing the lamp, and having a stout plate-glass front to allow the beam to pass outwards. The box is water-tight, so that the light will sustain no damage from the washings of the roughest seas. The lamp is an ordinary Maxim lamp, with two vertical carbon rods forming the arc, which is adjusted to the focus of the reflector by regulating screws worked from the outside by the operator. To enable him to do this without injuring his eyes by looking directly at the intense light of the arc, a small lens is made to throw an inverted image of the carbon points on a screen of ground glass. The silvered reflector behind the arc is eighteen inches in diameter, and of a parabolic form; and when it is desired to direct the light only on a distant ship, berg, or landmark, and extinguish all illumination in the immediate foreground, a funnel-shaped bonnet is placed over the front of the box, so as to allow only a slender beam of light to issue from it. With this apparatus a light can be projected strong enough to read by at five miles distance on a clear night, and many hundred feet in a dense fog. A smaller form has also been specially designed by Mr. Maxim for river steamers.

A Variable Lens.

The property possessed by the human eye of forming distinct images at all visible distances is, as is well known, due to the power of the crystalline lens to alter its focal length. This wondrous action is beautifully illustrated by the lens with variable focus recently invented by Dr. Cusco. This ingenious device consists of two fine glass discs set face to face in a suitable ring frame, so that there is an intermediate space which can be filled with water led from a small reservoir by means of a flexible pipe. The reservoir may either be a small

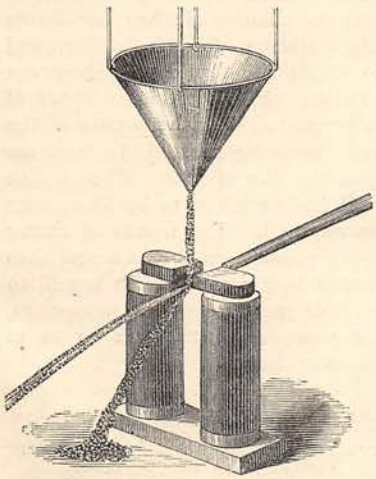
tank, which can be raised or lowered at will, in order to increase or diminish the pressure of the water, or a syringe bulb which can be pressed by hand. Under normal pressure of the water between them, the glass discs remain flat, and the water lens is therefore a plane one; but in proportion as the pressure is increased, the discs become more and more convex outwards, and a ray of light in passing through the lens is therefore more and more converged. In the same way a concave lens may be formed by gradually lowering the water-pressure. Not only is this device well worth inventing for its own sake, but it has also received a useful application in testing the focal length of solid lenses.

Photographing an Express Train.

An interesting application of the instantaneous method of photography was recently made by a firm of photographers at Henley-on-Thames. These artists were successful in photographing the Great Western Railway express train familiarly known as the "Flying Dutchman" while running through Twyford station at a speed of nearly sixty miles an hour. The definition of this lightning-like picture is truly wonderful, the details of the mechanism on the flying locomotive standing out as sharply as the immovable telegraph posts and palings beside the line. The photographers are now engaged, we believe, in constructing a swift shutter for their camera which will reduce the period of exposure of the photographic plate to $\frac{1}{5000}$ of a second. The same artists have also executed some charming pictures of the upper Thames, with floating swans and moving boats, which cannot but win the admiration of artists and all lovers of the picturesque.

Edison's Ore Separator.

The application of magnetism to the separation of magnetic sand and dross from metalliferous ores is not by any means a new idea. As long ago as 1792 a patent was taken out in England by William Fullarton, of Ayr, in Scotland, for a means of separating earthy particles from crushed iron ore by magnetic attraction. Twenty years ago M. Froment, an ingenious French electrician, devised a plan for separating magnetic oxide from copper ore, which in all essential features is the same as that recently brought out by Mr. Edison, and illustrated herewith. Edison's contrivance is designed for separating the "black sand" or magnetic oxide of iron from the gold-bearing dross known in mining parlance as "tailings"—that is, the dregs of gold-washings that are too poor in the precious metal to pay the expenses of extracting it. In some "tailings" there is a large percentage of "black sand," and if it can be got rid of cheaply the residual dross may then be rich enough in gold to pay for the working. Edison's plan for effecting this good riddance consists of a funnel or "hopper," through which the tailings are poured so that they will fall in a stream between the poles of a powerful electro-magnet. By means of a sidelong nozzle, shown in the figure, a blast of air is directed upon the falling vein so as to blow it from its vertical course. The non-magnetic dross, including the gold particles, is more readily blown away than the magnetic sand, which is pulled backward by the attraction of the poles, and the two kinds of dross fall in separate piles.



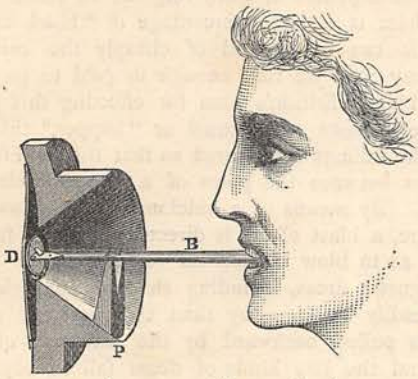
The Human Walk.

A well-known French *savant*, M. Marey, has been making a study of the human gait as exemplified in the walk of young soldiers put at his disposal by the military authorities of the Republic. He uses a novel instrument termed an Odograph, which is carried by the walker, and registers every step he takes on a sheet of travelling-paper. Each step is recorded on the odograph by a puff of air sent from a small collapsing bulb concealed under the sole of the person's boot. The results, which are likely to have a practical value in determining the best conditions of foot-gear, equipment, and diet for the marching of soldiers, as well as civilians, have already brought out very clearly the fact that a person takes shorter steps when the heels of his boots are low than when they are high, and also when the soles are tolerably thick, and prolonged beyond the toe, without being too rigid or too much prolonged. This discovery of itself argues against the present mode of wearing high-heeled, thin-soled boots.

A Telephone for the Deaf.

Deafness, in the majority of cases, is probably due to some defect in the auditory nerve, but there are many cases in which it is attributable to the air vibrations not reaching the nerve at all. In such instances the audiphone, as is now well known, proves of great service as an artificial drum for receiving the sonorous waves, and communicating their impulses through the bones of the head to the auditory nerve and brain. Various forms of audiphone have been described from time to time in the GATHERER, the latest and simplest being a sheet of stiff brown paper, with one edge placed between the teeth, and its convex surface exposed to the sound-waves. Quite recently the audiphone principle has been applied to the speaking telephone with success, by Mr. H. G. Fiske, of Springfield, Mass. His arrangement will be understood from the accompanying illustration, which represents a sectional view

of the mouthpiece of a telephone with the audiphone attachment. A blade, B, of resonant material, such as wood, or hard india-rubber, is connected to the centre of the metal plate, or vibrating diaphragm of the



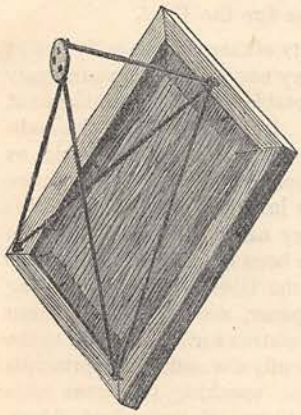
telephone, D, and supported by an elastic prop, P, fixed to the mouthpiece of the latter. The free end of the blade is inserted between the teeth of the listener, as shown, and its under surface is coated with an elastic substance, so as to prevent the vibration of the blade from injuring the teeth of the lower jaw. As in the audiphone, of course the sonorous vibrations of the telephone diaphragm are communicated to the bones of the head, and thence to the auditory nerve. It should be added that Mr. Fiske's device may be readily detached from the telephone, which can then be used in the ordinary way.

Earthen Filtering Plates.

Porous plates made of gypsum and earth combined in certain proportions are coming into use in Germany for filtering purposes. They are made by Messrs. Reye and Sons, of Hamburg, and can be purified either by washing or burning. When impregnated with carbolic acid they also act as disinfecting tablets.

A New Picture-Hanger.

The ordinary mode of hanging pictures and mirrors does not always show the work of art to perfection or pose the mirror so that it can be most serviceable. The American device illustrated in the engraving is an improvement on the old plan which will be found useful in many cases. It is so simple that any skilful metal-worker will be able to construct the parts from the figure. The hook-piece is screwed to the wall, and the mirror or picture can be inclined to any desired angle by moving it so that the cords will run through the screw-eyes let into the frame.



A Diffusive Lantern.

Globes of opal or ground glass are commonly employed for diffusing the rays from a powerful light such as that of the electric arc, but their use is attended by a loss through absorption of some fifty per cent. of the available light. To prevent so much waste M. Clemandot has devised the lantern shown in the accompanying engraving. The novel part is the conical wall of glass enclosing the light. It consists of flat tubes of glass welded together so as to form a corrugated surface, and these tubes are packed with the material known as glass-wool. The wool is composed of spun-glass fibres finer than floss-silk, and it can be packed loosely or tightly according to the degree of diffusion required. Moreover, it can be tinted various colours so as to tone the light. With this arrangement the loss of illuminating power by the absorption of the glass is not more than thirty per cent.

Making Fern Pictures.

Fern pictures can either be made by means of photography or by Indian ink. To get the photographic image a sheet of strong white or toned paper should be covered with a weak solution of salt in water and some white of egg well beaten. When dry it is to be taken into a dark room, and a solution of nitrate of silver (fifty grains to the ounce of water) brushed over it with a tuft of cotton. After being dried in the dark the coat of chloride formed on the surface is ready to receive the impression of the ferns. These are to be tastefully arranged between two panes of glass, and laid over the sensitised paper, which ought to be of the same area. The paper, with the ferns above it, is then to be exposed to daylight, and the image afterwards developed in a dark room by pouring over it a solution of hyposulphite of soda, which dissolves the chloride of silver, and leaves a fine residue of black silver to form the background of the picture, on which the fern forms show out whitely. To get Indian ink delineations a spray of fine mucilage is to be passed over the surface of the paper, and the ferns after being pressed in a book are to be arranged upon the film of gum. Then a fine spray of very diluted Indian ink is to be blown over them to the shade required. The fronds of course protect the underlying paper from the rain, and thus their forms are printed by the shower. It is well to apply several showers of spray to get the proper tint, letting the preceding one dry meanwhile so as to avoid forming globules of the ink.

Light for the Studious.

In a recent essay on artificial lighting from the point of view of the eyesight, M. Javal arrives at the con-

clusion that artificial lights are in general better to read and write by than daylight, owing to their containing fewer of the chemical rays than sunlight. The weakness of these lights, however, is apt to strain the pupils, and therefore there should always be a good supply of light. Two lamps are preferable to one; but daylight sifted of the excess of chemical rays by yellow spectacles is perhaps still better for the student than gas or lamplight. The flickering of the flame is very detrimental to the sight, and therefore gas-jets are better enclosed in opal or other diffusive globes.

The Electric Light under the Sea.

Of the many uses to which the electric light is now being put, one of the most interesting is its application to submarine exploration. It was first employed in this manner for the purpose of examining the wreck of the notorious *Alabama* which sank, after her contest with the *Kearsage*, off the French port of Cherbourg; but since that occurrence it has been greatly improved.

The electric light is contained in a strong cylinder, 4½ feet high and almost 4 feet in diameter, and furnished with a substantial plate-glass bottom. The lower part of the cylinder is supplied with alum-water in order to counteract the pressure of the sea, which increases very rapidly the deeper the appliance is lowered. In the upper portion of the cylinder there is an electric lamp of great power, the light from which, passing through the alum-water and the plate-glass, illuminates the bottom of the sea for a considerable distance, forming, so to speak, the central point of a circle with a radius of nearly 50 feet. Not far from the electric light, it is customary to station a Bazin's observatory. This apparatus is 9 feet high and 2 feet in diameter, and is provided with two bullseye windows, through which a person may inspect the divers at work, to whom instructions may be readily passed by the inspector, water being a good conductor of sound. The inspector may remain in the observatory for nearly 45 minutes, and in the event of the structure breaking or leaking, he can enter the upper helmet, where he may stay for 8 or 10 minutes longer, thus allowing plenty of time for the raising of the machine out of the briny depths.

A New Photographic Developer.

Captain Abney, a recognised authority on the art and science of photography, has for several years been in search of a developing agent which would only act on silver bromide which had been exposed to light and not on simple silver bromide. At last he has succeeded in finding such a substance in hydrokinone, which will develop both collodion and gelatine plates. In point of efficacy it is said to be more sensitive than the ordinary alkaline developer, but owing to its being rather a chemical curiosity at present than a useful preparation it is very expensive. Perhaps the creation of a demand for it will lead to a supply at some lower rate.

Heveenoid.

Heveenoid is the name given to a new preparation of india-rubber intended to supplant the soft and hard vulcanised rubber which has been in use for so long a time. *Heveen* is the name given to caoutchouc by the South American Indians, and the combination of this natural base with camphor-gum and sulphur constitutes the artificial material known as heveenoid. The process of manufacture consists in taking pure rubber—whether from Para, Nicaragua, or Madagascar does not matter—boiling it in water, masticating it, and drying at it a temperature of 150° Fahr. The camphor and sulphur are then incorporated with it conjointly. These ingredients are intimately mixed together by melting them together and powdering the amalgam. This powder is kneaded into the rubber by means of rollers, and the sheets of camphorated rubber are then pressed between sheets of tin and placed in the vulcaniser, which consists of an oven filled with steam. Here they are left for five hours, whereas by the old process hard rubber took thirteen hours to vulcanise. To make soft heveenoid the sheets, pressed between tin-plates and covered with soapstone, are vulcanised for only forty-five minutes. Heveenoid is the subject of a patent, and is manufactured by a company in New York. It is from thirty to fifty per cent. lower in price than ordinary vulcanised rubber, and it is held to be far more durable. Soft heveenoid has an agreeable odour of camphor, and both hard and soft varieties are free from any unpleasant smell of sulphur.

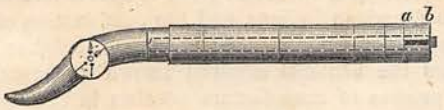
Japanese Air-Cushions.

The Japanese employ paper instead of india-rubber for making air-cushions, and it is said to form a more convenient article. Paper cushions roll up smaller than india-rubber ones, they do not stick together after being wetted, and having no odour they are more agreeable for pillows than those of caoutchouc fabric. Moreover, their strength is absolutely marvellous considering the apparent frailty of the material out of which they are made; a man weighing 160 lbs. may stand on one without bursting it. They are said to be waterproof, too, and to make good life-preservers.

A New Drawing-Pen.

An improved drawing-pen for the use of engineers, surveyors, and other mechanical draughtsmen has been introduced by a firm of pencil manufacturers. Unlike the ordinary drawing-pen now in use, the drawing-nib is not in a line with the holder, but, as will be seen from the accompanying sketch, it curves inwards. The two blades of the nib also tend by virtue of their own spring to close together, and the office of the small milled-headed screw is to force them apart to a distance corresponding to the width of the line required to be drawn. For this purpose the end of the screw bears on the inside of the further blade. The nib is fixed to the holder by a rod running through the latter, and terminating

in a screw, on which a washer, *a*, and a screw-nut, *b*, are fixed. The screw is graduated so that lines of any given thickness may be accurately drawn without the necessity of drawing trial lines to see if the proper thickness is attained. By slackening the



nut, *b*, the pen revolves quite freely in the holder, and thus by holding the stem vertically the nib will accommodate itself to any curve or intricate line, the point exactly following the motion of the hand. It speaks well for the success of this novel drawing-pen that it has been adopted into the German Government offices.

Recording Solar Radiation.

In studying the weather it is important to obtain a knowledge of the length of time the sun has been clearly shining, and in order to allow for the passage of clouds it is necessary that the apparatus should be self-recording. In the Kew Observatory a simple device, invented by Mr. Campbell, is employed. This is simply a lens formed out of a glass globe filled with water and exposed to the sunlight, so that it can focus the rays from the solar disc on a strip of moving paper behind it. The paper is adjusted at such a distance that the concentrated beam from the lens just chars the surface and leaves a brown mark to signify its action. The length of time the sun has been exposed can, of course, be found by the length of this mark and the speed of the paper. An improved register has, however, been recently introduced into the Douglas Observatory in the Isle of Man by its inventor, Mr. D. Winstanley. This consists essentially of a "differential thermometer" attached to the beam of a balance in such a manner that when the temperature of one bulb is higher than the other the beam tips on the side of the cooler bulb. This is the case when the sun strikes one bulb and the other is meanwhile kept in the shade. To register the movement of the beam a pencil is attached to the descending side, and this pencil, when the beam sinks on that side, comes in contact with a paper dial placed below it. This dial rotates with the hands of a clock, to which it is connected, and as the pencil remains in contact with it for as long as the sun is shining unobstructed, a mark is drawn round the dial for that length of time. Now the dial is graduated like a clock-face, into hours, minutes, and seconds, so that the duration of the direct sunlight is at once read off. In the latest form of the apparatus a brass wheel takes the place of the beam, and a fine metal point the pencil. This point is made to delineate the oscillations of the wheel on a vertical cylinder of paper coated with lamp-black. The cylinder is driven by a clock as before, and makes one complete turn in twenty-four hours. The "radiograms" thus obtained reveal the curious fact of a "thermal twilight," that is, a gradual increase of temperature before the sun rises. They also show that during a few minutes before and after midnight there is a mysterious rise of temperature, although the sun is then at the very opposite side of the world.

To Cultivate Water-Lilies.

So many of us—ladies especially—are desirous to obtain water-lilies when boating, that a few directions as to their cultivation near home will doubtless be acceptable to our readers. We have been given to understand that the pond-lily (*Nymphæa adorata*) is easily cultivated. Take a good-sized barrel and sink it into the ground, place in it some soil of the lake, or pond, or river in which you have observed the lilies flourishing, put in the lily roots you have obtained, and fill the barrel with water. At the proper time the buds will appear, and in August the surface of the water will be a beautiful sight. The growing surface can of course be enlarged, and if a little manure be added in the autumn and the tank or barrel covered over, the lilies will be much improved the following year.

A Simple Spy-Glass.

A useful telescope, suitable for travellers and pedestrians who wish to avoid carrying personal luggage, is illustrated in the accompanying figure. It

is the device of Herr T. Geiger, of Stuttgart, and consists of a concave eye-lens, *a*, and convex object-glass, *b*, mounted on a straight walking-stick or cane some twenty or thirty inches apart. The lenses are attached to the cane by means of spring clamps, and the object-lens can be slid to and from the eye-lens along the stick so as to get a proper focus. The lenses may be simply held in the hands and pointed to the object, but the stem of the cane is a useful axis.

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