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THE CENTENNIAL BUILDINGS.

We have already placed before our readers views of the Main Building and the Art Gallery, now being erected for the Centennial Exposition, in Fairmount Park, Philadelphia, Pa.; and we herewith publish a view of the Horticultural Building, a large conservatory: an extremely ornate and commodious building, which is to remain in permanence as an ornament of Fairmount Park. It is located on the Lansdowne Terrace, a short distance north of the Main Building and Art Gallery, and has a commanding view of the Schuylkill river and the northwestern portion of the city. The design is in the moresque style, the principal materials externally being iron and glass. The length of the building is 383 feet, width 193 feet, and hight, to the top of the lantern, 72 feet.

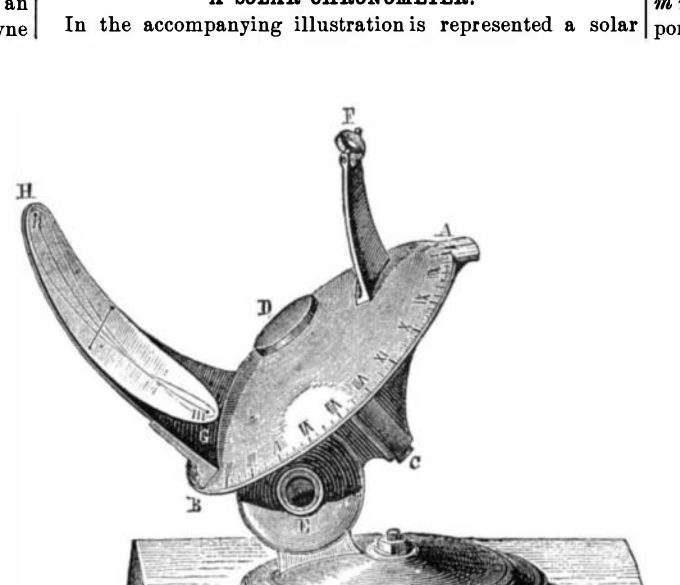
The main floor is occupied by the central conservatory, 230 by 80 feet, and 55 feet high, surmounted by a lantern 170 feet long, 20 feet wide, and 14 feet high. Running entirely around this conservatory, at a hight of 20 feet from the floor, a gallery 5 feet wide will be erected. On the north and south sides of this principal room are to be four forcing houses for the propagation of young plants, each of them 100 by 30 feet, covered with curved roofs of iron and glass. Dividing the two forcing houses in each of these sides is to be a vestibule 30 feet square. At the center of the east and west ends are similar vestibules, on either side of which will be the restaurants, reception room, offices, etc. From the vestibules ornamental stairways will lead to the internal galleries of the conservatory, as well as to the four external galleries, each 100 feet long and 10 feet wide, which are to surmount the roofs of the forcing houses. These external galleries are to be connected with a grand promenade, formed by the roofs of the rooms on the ground floor, which have a superficial area of 1,800 square yards.

The east and west entrances will be approached by flights of blue marble steps from terraces 80 by 20 feet, in the center of each of which an open kiosque, 20 feet in diameter, is to stand. The angles of the main conservatory are to be adorned with eight ornamental fountains. The corridors which connect the conservatory with the surrounding rooms, open fine vistas in every direction.

In the basement, which is of fireproof construction, are the kitchen, store rooms, coal houses, ash pits, heating arrangements, etc.

A SOLAR CHRONOMETER.

In the accompanying illustration is represented a solar chronometer, recently invented by M. Fléchet, from which, according to *La Nature*, the hour may be determined with accuracy. It consists of a rounded disk, A, divided into 24 hours and their fractional parts. This turns about an axis, C D, which is placed parallel to the earth's axis according to the latitude of the place, by means of the point, E. F is a lens, located in the center of an exactly spherical concave plate and capable of adjustment toward the sun.



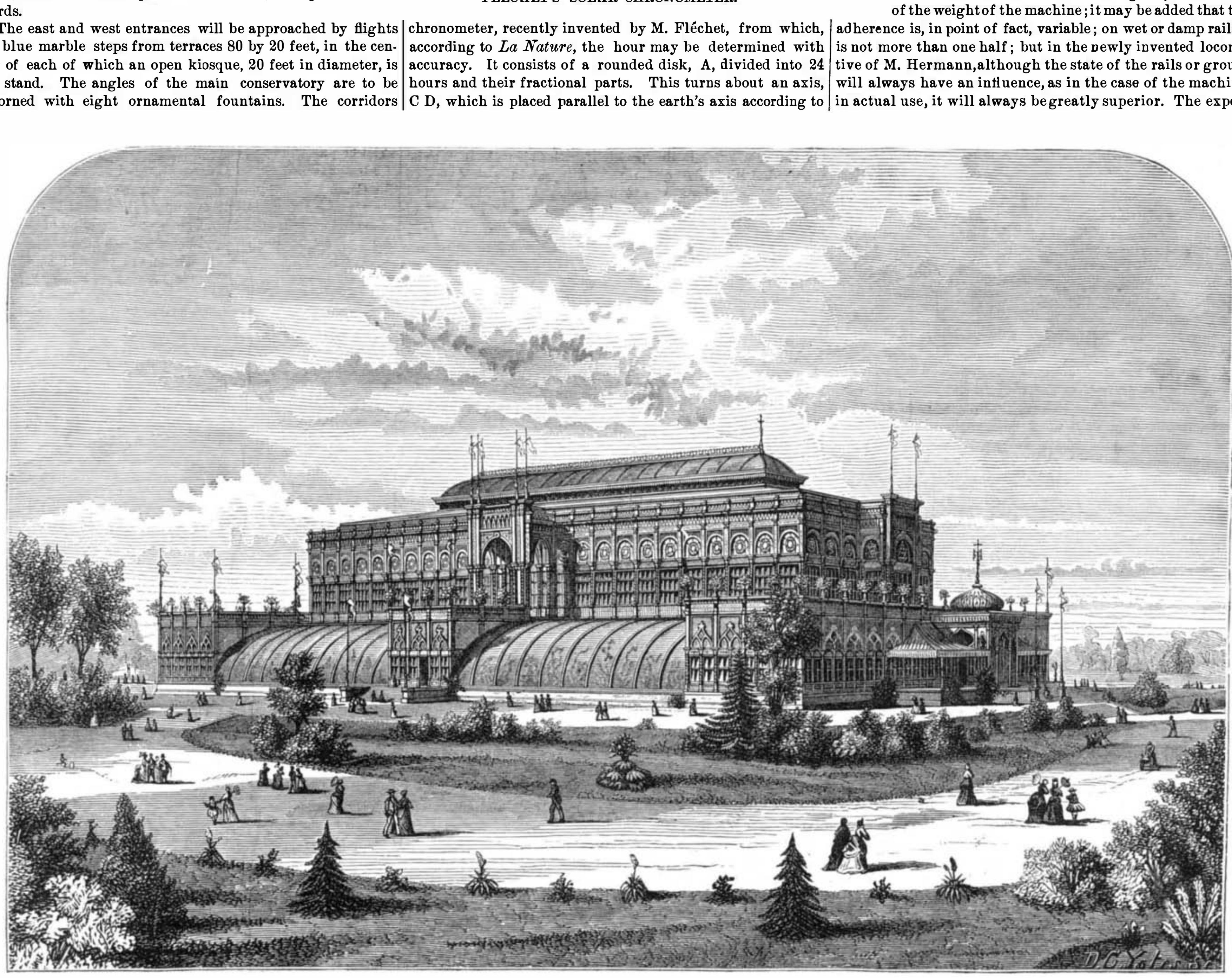
FLECHET'S SOLAR CHRONOMETER.

When the instrument is arranged so that the axis is inclined as above noted, the disk, A B, is turned so that the image of the sun produced by the lens, F, falls on the arc, *m n*. The hour is given by the pointer at A, and the corresponding hour mark on the disk. The instrument is said to be accurate within one quarter or one third of a minute.

The Steam Donkey.

At a recent *séance* of the French Academy of Sciences, some interesting particulars about a new locomotive of M. Fortin Hermann were given: Its propulsion is produced by the rising and falling of six articulated feet, which strike the ground or rails something like the feet of a quadruped. These feet are arranged in two groups, three support the fore part of the machine, and the other three the after part. The two middle feet are connected together by a horizontal shaft; the four others are independent, and strike the ground successively in such a manner that, while the middle feet move at a moderate pace, the others have a highly accelerated motion. Each of these groups of three feet is affixed to a single trunk. The force of the steam is applied in such a way as to drive these feet toward the ground.

The experiments made by the Eastern Railway Company at Paris with one of these machines have demonstrated that, when the feet are shod with soles of india rubber weighing one kilogramme (2·2 lbs.) each square centimeter (4-10th inch), an adherence to the rails or road is obtained equal to three fourths of the weight of the machine itself. In the ordinary locomotive this adherence does not go beyond one fifth of the weight of the machine; it may be added that this adherence is, in point of fact, variable; on wet or damp rails it is not more than one half; but in the newly invented locomotive of M. Hermann, although the state of the rails or ground will always have an influence, as in the case of the machines in actual use, it will always be greatly superior. The experi-



CENTENNIAL HORTICULTURAL BUILDING PHILADELPHIA PA.

ments made thus far prove that this new machine will drag on ordinary roads, or on rails, a train four times as heavy as the ordinary trains; the cost of this augmented train will not, it is said, vary materially from that of the ordinary machines with the usual trains when used on equal grades; but the increased adhering power of the new locomotive will permit of the employment of a lighter built machine for the usual trains, as well as the power to surmount steeper grades than are usual on the railways of the present construction.

This new system of M. Fortin-Hermann enlarges very greatly the capacities of all locomotives for any roads, and will allow of passing through ground where roads have not been constructed, and up grades of one foot in ten.

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THE EDUCATION OF SIGHT.

As the reader's eyes rest upon this page of the SCIENTIFIC AMERICAN, a very complex impression is conveyed to his mind. He perceives a contrast of light and shade, the white paper and the black ink. The dark portions exhibit various forms, which stand in definite positions with reference to each other and to the reader. The paper lies at a recognized distance from the reader's eye. It has form and size, a certain degree of smoothness, and certain roughnesses indicating lines of print on the reverse side. Further looking will discover a succession of black forms—letters, words, etc.—conveying the ideas now in the writer's mind.

How much of all this is strictly speaking, seen? How much is the result of ulterior processes?

Paradoxical as it may seem, the reader's eyes report only the first mentioned contrasts of light and shade: all the rest is extravisual. In other words, when we look at a complex object, say a landscape, the eye distinguishes light and shade only: the situation, direction, distance, form, size, etc., of the several objects which produce lights and shades, we have to determine by other means, for the discovery of which we are indebted to the patients of Cheselden, Home, Wardrop, Franz, and others, who were born blind and given the power of vision in later years by a surgical operation.

In all these cases, we believe, the cure consisted in the removal of an overlying growth which eclipsed the otherwise perfect organ of vision. In each case the patient was sufficiently mature to report the exact nature of the sensation aroused by the act of sight on the part of a perfect but uneducated eye—uneducated, that is, in respect to motion, and unaided by any knowledge acquired by the other senses. Their experiences, therefore, clearly demonstrate the scope of pure vision in all persons, and also the origin of the ideas of form, size, distance, etc., which seem to arise in our minds through simple seeing.

Of the earliest patient, Cheselden's, it is recorded that "he knew not the shape of anything, nor any one thing from another, however different in shape or magnitude," and the same is substantially true of all the others.

Ten minutes after his eyes were opened, Home's patient was shown a round piece of card, and was asked the shape of it. He could not tell till he had touched it. The next moment a square card was shown him, and he said it was round like the other. He said the same of a three-cornered card. He was then asked if he could find a corner on the square card. It was only by much thinking that he decided that the card had a corner, after which he readily recognized the other three corners.

An exceedingly instructive subject was a lady operated on by Wardrop: she could merely distinguish a very light from a very dark room, so complete was her blindness. At first she saw only patches of light and shade; by degrees she learned the names of colors and was able to distinguish them, though unable to interpret the chaos of color impressions she received. On the seventh day after the operation, she was seen to examine some tea cups and saucers. She thought them queer, but could not tell what they were till she touched them. Similarly she saw but failed to recognize an orange. On the eighteenth day, a key and a pencil case, with which she was perfectly familiar by touch, were placed side by side on a table before her: she could not tell which was the pencil case, which the key. At the end of three weeks, she saw a grassplot simply as a large and beautiful patch of green in her field of vision. How far it might be from her she had no idea. Usually in cases of this sort, the patient imagines at first that all that he sees touches his eyes, just as objects felt touch the skin.

On the twenty-fifth day, Wardrop's patient was taken out in a carriage, and inquired continually as to the meanings of her visual sensations. A person on horseback was vaguely a large object. She asked: What is that? of a soldier; and of some ladies wearing red shawls she inquired: "What is that on the pavement, red?"

At the end of six weeks it was found that she had acquired a pretty accurate knowledge of colors and their shades and names, but was unable to judge of distances or of forms, and the sight of all new objects was still very confusing. Neither was she able, without considerable difficulty and numerous fruitless trials, to direct her eyes to any object: when she attempted to look at anything, she turned her head in various directions until her eye caught the object she was in search of.

That our power of "seeing" solids is also extravisual was clearly shown in the case of Franz's patient. Among the observations reported of this patient, the following applies here: A solid cube and a sphere, each of four inches diameter, were placed before him, three feet off and at the level of his eye. After attentively examining these bodies, he said he saw a quadrangular and a circular figure, and after some consideration he pronounced the one a square and the other a disk. His eye was then closed, the cube taken away, and a disk put in its place. On opening his eye, he observed no difference in these objects, but regarded them both as disks. The cube was now placed in a somewhat oblique position before the eye, and close beside it a figure cut out of pasteboard, representing a plain outline prospect of the cube when in this position: both objects he took to be somewhat like a flat quadrate. A pyramid placed before him, with one of its sides turned toward his eye, he saw as a plain triangle. Placed so as to present two of its sides to view, the pyramid was a puzzle. After considering it a long time, he said it was a very extraordinary figure. It was neither a triangle nor a quadrangle, nor a circle; he had no idea of it and could not describe it. When he took the sphere, cube, and pyramid into his hand, he was astonished that he had not recognized them as such by sight, being well acquainted with them by touch.

What these patients had to learn in later life, more fortunate individuals born with unclouded eyes learn in infancy, but so forget the process that the acquirement seems to be innate, a simple function of the unaided eye. The mechanism involved in the process is described in every good treatise on human physiology: the metaphysics of the case are cleverly discussed in Taine's treatise "On Intelligence." Those of our readers who have taken issue with our remarks with reference to sight will find both aspects of the subject well worth pursuing in those works, to greater length than is possible in our limited space. The facts given are sufficient to sustain the position taken by us on this point in previous articles.

SOME NEW VOLCANO REVELATIONS.

The theory that our earth was successively a vaporous, a fluid, and a plastic mass, which, by cooling during billions of centuries, finally obtained a solid crust, in connection with the fact that during all this time she rotated round the sun and received on her equator solar heat (of which the poles were nearly deprived), leads necessarily to the conclusion that, in the neighborhood of the poles, the slowly forming solid crust must have become thicker than it is around the equator, because the solar heat was able to retard this cooling longer at the equator than at the poles. Such a crust is of course more easily perforated, by interior pressure acting outwardly, where it is thinnest; and volcanoes, which are the result of such perforation, must therefore be more numerous in the thinner places, such as around the equator, and scarce near the poles. This is confirmed by observation. Active volcanoes are not frequent around the poles; the only one near the north pole is in Iceland, while between the tropics such volcanoes are found in considerable numbers.

Another interesting consideration is that the amount of material ejected by volcanoes is enormous. The estimates so the volume of the lava ejected by Vesuvius, Etna, and especially by the volcanoes of Iceland are appalling figures; and all these masses necessarily come from the interior of the earth, and must create in the neighborhood of the volcanoes (which may be considered as safety valves) empty spaces, which are filled up by a sinking of the crust. This logical conclusion has been verified by the observation that every active volcano is situated in the center of a region of depression, and never in one of upheaval, unless the material ejected by the volcano itself be so considered.

But a still more remarkable fact has been revealed by the calculations of astronomers making observations at different points of the earth's surface. It is that there are two points of depression, extending even over the ocean's surface, forming a kind of flattened poles, one the exact antipodes of the other. These points are the Antilles, in the West Indies, and the Sunda Islands (Java and its surroundings), in the East Indian Ocean. Each region contains a greater number of active volcanoes in a smaller surface than can probably be found anywhere else on the earth. But the reason why the ocean's surface partakes of this depression, at these two volcanic centers, is as yet a problem. Modern observations have already proved many irregularities in the form of the ocean's mean level, making the ocean's surface to be far from a perfect spheroid. As this surface must, according to the laws of hydrostatics, be always at right angles to the direction of gravitation, it proves that, at various points of the earth's surface, the lines of gravitation do not pass through the same central point, even on places of the same latitude. As gravitation is a general property of matter, depending on its mass, it proves that the mass in the interior of the earth is not homogeneous nor of uniform density, and that it is unequally distributed. As the interior is liquid, this distribution may be affected by cosmic influences, as for instance the relative position of the moon and planets; and any change effected in this distribution may react on the direction of gravitation on the earth's surface, and so on the form of the ocean, and thus slowly produce changes in its level, which may, in some cases, cause an apparent rising or depression of the land.

PROGRESS OF RAPID CITY TRANSIT.

The new Commissioners of Rapid Transit in this city are daily holding their sessions, and day by day their perplexities increase, if the published newspaper reports of their proceedings are correct. They are unable to agree either upon the plan of construction or upon the proper route. The original assumption that the Commissioners were committed to the election of some form of cheap elevated railway resulted in the production of a multitude of plans of that order: and the promoters of some of these plans are backed by influence which is not without effect upon the minds of the Commissioners.

The indications at present are that, if any plan of rapid transit is adopted now, it will be one comprising some form of cheap elevated structure to meet an immediate want, with little reference to ultimate economy. Not what is really best and cheapest, but what is least expensive at first, seems likely to win. The question, therefore, is not so much which of the temporary devices to adopt, as where the road shall be put.

All but two of the plans for elevated roads, laid before the Commissioners, propose to take possession of the public streets. Their projectors are no doubt able to demonstrate to their own satisfaction that such an occupation of the sidewalk or the roadway would be of signal advantage to any street which should be chosen as the route of their road: but can the occupants and property owners of any street be made to believe it?

If we are to have an extension of elevated rapid transit, which now seems quite probable, the public ought to insist that the new roads be put where they will do least injury to property and business, that is, *between the streets*, not over them.

The worst fallacy connected with this whole matter is the assumption that economy dictates a temporary structure of small capacity—a cheap affair to meet a pressing present need. The city of New York is in its infancy. Much as it needs rapid transit, and scarce as money is now, the metropolis of the country cannot afford to begin ill-advisedly, however cheaply, in a matter which must largely determine its future prosperity and growth.

The example and experience of the great city of London would be a very safe one for New York to follow. Rapid transit is chiefly effected in London by underground railways, which ramify in all directions; but as they are placed below the level of the streets, out of sight, their operation disturbs no one, while their advantage to the public is so great that every year witnesses their extension.

Sir Edmund Watkin, a member of Parliament and President of the Metropolitan (London) Underground Railway, and of the London and Great Eastern Railway, is now in this country; and a few days ago, at the request of the New York Rapid Transit Commissioners, he addressed them, giving a number of interesting particulars concerning the present status and operation of the rapid transit railway system of London.

The London Underground Railroad Company, he said, already had about sixteen miles of road in operation, and in a few months they would have twenty miles of completed road. They were negotiating for a still further extension of their routes, and would in time burrow under the whole city of London. These roads had proved to be a greater convenience to the poorer classes than to wealthy persons. The average fare collected was five cents, and the rate per mile was reduced by a system of commutation to one penny. Last year these roads carried 70,000,000 passengers. Heavy