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THE TRANSIT OF VENUS.

The sky was overcast throughout a great part of the United States on the morning of December 6; and, as a rule, the atmospheric conditions during the time of the transit were not favorable for continuous and exact observation. Yet there were but few places at which no observations of value were possible, while at most of the stations enough was accomplished to make the watching astronomers fairly well pleased with the results of their day's work.

In this city the observations were fairly good after the first contact, which was missed, until toward the end of the transit, when the sky became overcast again.

At the Naval Observatory, Washington, all four contacts were observed with the twenty-six equatorial, the first and last contacts through thin clouds. The sun was obscured during the middle of the day, yet a number of good measurements of the diameter of Venus were secured. No black drop or other extraordinary phenomenon was observed, except by Superintendent Sampson at the last contact. Some fifty photographs were secured.

At Princeton, Professor Young observed all four contacts, partly through thin clouds, but on the whole satisfactorily, and took one hundred and eighty-eight photographs, mostly excellent; some were affected by clouds. Complete measures of the diameter of Venus were obtained by both filar and double image micrometers. Spectroscopic examination of the planet's atmosphere showed lines of water vapor conspicuous, and some unknown lines.

At the Allegheny Observatory, Pittsburg, Professor Langley's observations were only partially successful. Clouds prevented exact determinations of contacts and all photometric and spectroscopical work. He noticed a curious and novel phenomenon as the planet was entering upon the solar disk. When Venus had about one half entered on the sun's face, a tolerably bright point of light was seen near the circumference of the dark body of the planet outside the sun, and where no direct ray of sunlight could reach it. The position angle of the center of the bright spot was about 172 degrees, and it extended for something like 30 degrees along the planet's limb. It was luminous and distinct, and, Professor Langley thinks, was certainly not a phenomenon of irradiation, nor due to any instrumental cause, but what its physical signification is he could not conjecture. It was observed with the great equatorial and a magnifying power of 244, used with the polarizing eyepiece by Professor Langley, but was seen also and quite independently by his assistant, Mr. J. E. Keeler, with a very much smaller telescope and a power of 80.

Observers in other places noticed light spots in the surface of Venus, some suspecting them to be snow-fields.

The observations of Professor Eastman, at Cedar Keys, Florida, were quite successful, though the first contact was lost by the intervention of a cloud. The second contact was obtained very well; no black drop or ligament was seen, and the limbs of Venus and the sun were very steady. The sky was mostly clear from 11 o'clock to 1h. 40m. One hundred and fifty photographs were taken with dry plates and thirty with wet plates, all good. The third and fourth contacts were very well seen, with no black drop.

The observations made at Yale College were much impaired by clouds. Professor Waldo reports over one hundred and fifty photographs, showing the full sun with a reference line from a horizontal mercurial surface photographed at the same time. The heliometer observations were particularly successful, and the definition of the sun in spite of the clouds was such as enabled the atmosphere of Venus to be clearly visible in the heliometer, and the silvery aspect which this atmosphere assumed between the third and fourth contacts was clearly discerned.

Considerable good work was done at Cambridge Observatory. The German astronomers at Hartford, Conn., secured eight sets of observations with the heliometer. The German party at Aiken, S. C., were less fortunate. The French observers at St. Augustine, Fla., had a clear day. All the contacts were perfectly taken, two hundred photographs were secured, and many micrometrical observations were made. Professor Asaph Hall and the Belgian party at San Antonio, Texas, missed the first two contacts, owing to clouds. The last pair were taken perfectly, no black drop or point of any kind being seen. Professor Houzeau obtained, in addition to these contacts, one hundred and twenty-five measurements. Professors Hall and Woodward got over two hundred good photographs.

At the Lick Observatory, Mount Hamilton, Col., the day was splendidly clear, and many photographs were taken.

The European observers were generally thwarted by bad weather. Favorable observations are reported from Cape Town and Durban, South Africa.

Professor Davidson's party in New Mexico were favored with a clear sky and steady atmosphere. The contacts were clearly observed. Two hundred and sixteen excellent photographs were obtained, and a large number of measurements were made with great precision. Indeed, not a single item in the long programme of the day's work was missed. At nearly all the Mexican stations the weather was good. The observations of the French Commission in Puebla were entirely satisfactory.

Favorable reports are also made by observers in the West Indies and Central America. At Melbourne, Australia, successful observations were made, but observers in Queensland and Sydney were disappointed. The American party at Wellington, New Zealand, took two hundred and thirty-six photographs.

THE GREAT STATUE OF LIBERTY.

A large and enthusiastic meeting was held in this city November 28, to promote the subscription for the pedestal of Bartholdi's "Liberty Enlightening the World," to be presented to the United States by the French nation and erected on Bedloe's Island, New York Harbor. A number of addresses were made by prominent citizens.

The chairman of the committee having in charge the collection of money for the pedestal, Hon. Wm. M. Evarts, after reviewing the circumstances under which the project was started in our Centennial year, said that a communication had just been received from the Committee of the Franco-American Union describing the popularity of the project in France. As early as the year 1881 the enterprise had been indorsed by 181 towns in France, acting through their municipal council, by 40 general councils of as many provinces, by all the chambers of commerce of the great cities of the republic, and by 100,000 individual subscribers. The statue will probably be ready for transportation next summer.

Touching the magnitude of the proposed monument, Mr. Evarts said:

The simple statue will be, from the plinth to the top of the torch, 145 feet in height. From the water level up to the highest point in the span of the Brooklyn Bridge is but 135 feet—10 feet less than this truly colossal statue. The dimensions of the plinth, the space occupied by the feet and drapery of the figure, is 40 feet square—as large as a house. It is fitting that so noble a monument of skill and industry, so generous a contribution, should be framed as a munificent gift from the French people, as one of the great evidences that the great international relations of value and importance between great countries are no longer maintained by courts and cabinets, but spring out of the intermingling pulses of the people.

The great Colossus of Rhodes, known in its time as the seventh wonder of the world, was erected to show the gratitude of the Rhodians to the Egyptian king who was their ally in war when their liberties were threatened by the King of Macedon. They were a small people, inhabiting an island of but 450 square miles, but that great work of theirs was erected at a cost of 300 talents, of the value then of between $400,000 and $500,000. It was but 105 feet high. This statue of Liberty Enlightening the World will be 145 feet high, upreared upon a pedestal of equal height, and will be, not the seventh wonder of the world, for the wonders of the world are never ceasing in number, but will be the wonder of the world as much greater than the Colossus of Rhodes as the world now, of which it will be the wonder, is greater than the world of the Mediterranean Sea in classic times. The largest modern statue is the one near Lake Maggiore, in Italy, erected to the great Christian saint, Charles Borromeo, which, upon a pedestal 40 feet in height, is in itself 66 feet high. Nothing in the history of the world has approached the greatness of this statue of Liberty. Our genius did not conceive so great a statue; our art and our munificence have not contributed to its production. This great free gift we are simply called upon to receive, to place upon a perpetual site under the perpetual care provided by the Government of the United States, on a pedestal that comports in dignity and in solidity with the statue it is to bear up, and which shall comport with the wealth and the numbers of these great cities and this great country, and show our appreciation of the debt we can never repay to France, and which she simply adds to by this magnificent gift. The numbers of those who will come hither to see the light of this commemorative statue no man can count, and they shall not cease coming until liberty itself shall have ceased to enlighten the world, nor until this home of the free shall cease to attract the footsteps of the multitudes that seek this shrine and this safety for their love and exercise of liberty.

All the conditions of our acceptance of this great conception and great execution are already fixed. The French have spent $250,000 upon the statue, and the best computation, without unnecessary expense, fixes the cost of the pedestal at $200,000 to $250,000.

THE PROPOSED COTTON CENTENNIAL.

The great success of the cotton fair at Atlanta, and the resulting advantages to the cotton growing States, have led to a still more ambitious project, which the South ought not to allow to fail. It is nothing less than a World's Fair in commemoration of the hundredth year of the cotton industry of this country. The first shipment of American cotton across the Atlantic was made in 1784, when eight bags were sent to England, where the cotton was seized by the customs officers on the ground that it could not have been grown in the United States, and was therefore liable to seizure under the shipping acts as not imported in a vessel belonging to the country of its growth.

The National Cotton Planters' Association of America are responsible for the proposition and the choice of date for holding the fair, and are now waiting to see which of the commercial cities of the South will subscribe the half million dollars for the choice of location. In a recent press communication the President of the Association, Mr. F. C. Morehead, says:

"It is proposed to raise not less than $2,500,000, one-fifth of which, at least, will be required as a subscription from the city securing the exposition. Every kind of machinery used in the manufacture of cotton is expected to be exhibited in motion and at work just as in the factory. The utmost importance will be attached to exhibits of improved plantation machinery and agricultural implements, and special inducements will be offered with a view to placing before the planters and farmers the most approved appliances for successful diversified farming, the encouragement and stimulation of which is one of the chief missions of the National Cotton Planters' Association and one of the chief benefits hoped to be derived from the proposed exposition."

Under proper direction such an exhibition could not easily fail to be popularly successful and of great benefit all around. Though the chief benefit would accrue to the cotton growing States, the cotton manufacturers, machine builders, and makers of agricultural implements and machinery throughout the country would share in the general profit.

The South is to be the region of the greatest natural and industrial development during the next two or three decades; and nothing is better calculated to hasten such development than the demonstration of the capacities, needs, and possibilities of the Southern States by means of great popular expositions of their resources and requirements.

THE TRANSIT OF VENUS AS SEEN AT THE SEAGRAVE OBSERVATORY.

The transit of Venus on December 6 was as successfully observed as the clouds would permit at Mr. F. E. Seagrave's private observatory in Providence, Rhode Island. The telescope is a fine instrument of eight and a quarter inches aperture, made and equatorially mounted by Messrs. Alvan Clark & Son, of Cambridgeport. The observatory is of the first order, including every kind of apparatus that will furnish aid in astronomical research. The owner of the observatory is a young man, endowed with a natural taste for astronomy, zealous and untiring in the investigation of the science, and possessing ample facilities for the pursuit of his favorite study.

The contact and photographic methods were used in the observations made during the transit.

The polar and equatorial diameters of the planet were measured by means of a double-image micrometer. The contacts and general course of the planet were observed by Mr. Seagrave through the large telescope in the observatory, the aperture having been diaphragmed or cut down to three inches to make it available.

A small building erected for the purpose was devoted to the photographic work in charge of skillful operators. An able assistant had charge of the three-inch telescope, stationed in the open air, and used for the micrometrical measurements of the planet's diameters.

The observing party was promptly on hand to commence work as soon as the sun should appear. A few minutes before the time for the momentous event of the day, the great luminary burst forth from the encompassing clouds and shone from a clear sky. But at the critical moment, a dark cloud flitted over his face, and the first external contact was lost. When the cloud passed, Venus had made the entering notch and was partially on the sun's disk, the view being unimpeded until she was entirely on his face and had made her first internal contact, the observed time differing a minute and three-quarters from the predicted time. This aspect was very satisfactory, for Venus left the sun's border without any appearance of the connecting ligament known as the "black drop," while the film of light surrounding her proved the existence of an atmosphere beyond dispute. As the transit progressed, the sky was by turns clear and obscure until 2 o'clock, when the clouds became masters of the situation, and the scientific work virtually ended, though glimpses of the planet were occasionally obtained as she reached the second internal contact, and finally, arriving at second external contact, made her exit into the immensity of space, where she was lost to view. Every moment of clear sunshine was improved in photographing the sun with the planet on his disk, and twenty-three excellent pictures were the result. Several measurements of the planet's polar and equatorial diameters were made, which are yet to be reduced. Thus the Seagrave observatory contributed its share to swell the roll of observations that must be multiplied like grains of sand upon the seashore before certainty can be reached. It is probably the last time that so much scientific stress will be laid upon a transit of Venus. For before the next one, in 2004, we have faith to believe that other and more accurate methods will be found for computing the sun's distance.

Independent of the scientific work accomplished, there was the highest kind of enjoyment in watching the grand phenomenon itself. Through the large telescope, Venus looked like a sphere of inky blackness, larger than the full moon, and crowned with a film of light. She filled nearly the whole field of vision, only a small portion of the sun being visible outside of her, and this was paled into bluish white light, by the colored eye-piece that alone made it possible to behold the solar brightness. Through a three-inch telescope the aspect, though not so wonderful, was far more interesting. Here she looked as large as a ball that children play with, black as ink, moving serenely over the sun's disk, the whole lower limb of the sun being easily brought into the field of vision. Through smoked glass, the eye could just discern the planet passing like the head of a black pin over the sun's face.

The view in the small telescope was the most suggestive of the whole. Here, apparently, is a little black ball easily held in the palm of the hand, clinging to the sun's surface as it glides over it. In reality, the little ball is a great globe almost as large as our own, dwindled into tiny dimensions by a distance of twenty-five million miles, and separated from the sun, on which it seems to hang, by a distance of sixty-seven million miles.

The transit of Venus is a feature of special interest, a mirror in which we may see the semblance of our own planet. For as Venus looks to us, so does the earth look to observers on Mars when she makes her transit over the sun. Perhaps, while we watch the transit, observers in Venus are watching the earth. It is night on the beautiful planet, for the dark side is turned toward us. In the starlit sky arching above her, a star rises when the sun sets, and shines through the entire night. This brilliant evening star is the earth in opposition, and, accompanied by a tiny moon, she is larger and more brilliant than Venus ever appears in our sky. For when we see Venus in her brightest phase, she is a crescent. When, observed from Venus, the earth is seen in her brightest phase, her whole illumined disk is turned toward her sister planet.

A POSSIBLE FIELD FOR RAILWAY ENTERPRISE.

Some of the English papers are discussing the merits of a system of freight roads proposed for the manufacturing districts of Lancashire, England. In that region a vast amount of material, raw and manufactured, is subject to transportation for short distances. The railway charges are exceptionally high, and the cost of repeated handling adds materially to the burdens of manufacturers and dealers. For instance, a bale of cotton received at Liverpool is lifted out of the ship's hold and deposited on the quay. It is then lifted upon a cart and hauled to the railway station. There it is unloaded, and after one or more handlings is reloaded in a freight car, and after a long succession of shuntings the car is marshaled into its proper train and started for Manchester. Here another series of handlings are in order, ending with the delivery of the cotton at the factory. From the mill back to the ship, the manufactured cloth is subject to the same treatment, largely enhancing its cost to the shipper. Indeed, owing to multiplied handlings and excessive railway charges, the cost of sending goods from Liverpool to Manchester is said to be actually greater than it used to be before railways were introduced.

The magnitude and urgency of the traffic forbid a return to the old cartage system for the whole journey; so a compromise is proposed in the form of a "plate way," on which ordinary wagons are to be hauled by steam motors.

The estimated cost of the plate way and its equipment is about $175,000 a mile, which would build a respectable railway in the American style. Obviously, the carrying capacity of a plate way used by ordinary road wagons would be much less than that of a regular railway.

The question arises whether the avoidance of repeated loading and unloading of freight could not be secured, and all the advantages of the railway retained, by simply transporting the loaded wagons upon properly constructed flat cars, to be hauled by locomotives in the usual way.

Of course this plan would be feasible only where the railway carriage was short, compared with the rest of the haulage, as, for example, between the wharf or warehouse of the city and the factory in the suburbs or in a near-by town, or between an outlying market garden district and the city market.

In many American cities from which railways radiate to all points of the compass, this method of transportation might prove decidedly economical, especially in saving repeated and destructive handlings of fruit and vegetables brought in from the surrounding country. The farmer's loaded wagon might be hauled upon a platform car, as upon a ferryboat, and carried with its team and driver to the city station, whence it could proceed to market without delay. Or those whose market business is extensive might have relays of horses and drivers, and send the loaded wagons only by rail.

Vast quantities of farm and garden produce are hauled in road wagons fifteen or twenty miles to city markets. Railway facilities for the larger part of the distance, and for distances considerably beyond the present range of road haulage, would seem to offer many advantages; while the saving in time and wear and tear of wagons, harnesses, and teams would amply offset reasonable railway charges.

INVENTION AS A MEANS OF EDUCATION.

Young people are commonly dissuaded from exercising their native talent for invention by, or because of, the mistaken opinion that youth is exclusively a time for learning what others have done; that it is altogether improbable that any discovery or invention a young person may make can be either new or of any value. Any utility that a boy can recognize or develop, it is too commonly thought, must of necessity have been discovered and tried before; and it would only be a waste of time to reinvent old or impracticable devices.

This opinion involves two grave errors. In the first place, it is not always a waste of time to rediscover or reinvent, though there may be no immediate money profit to be got from such work. Original investigation and creative thought have a high educational value always; and the profitable art of invention is best acquired by inventing, even though fifty other men may have individually worked out the same practical problems before. For mathematical training, the patient and thoughtful solving of problems brings the same discipline, no matter how many other students have already solved the same problems. The skill which a young draughtsman may acquire in the work of sketching machinery off-hand is not lessened in any way by the fact that the draughting-room of the machine shop is full of much more perfect drawings of the same machinery than he can hope to make.

In like manner the time of the young inventor may be most profitably employed in inventing, even when it turns out that the product of his labor is nothing new. Indeed, there is no better way for the young inventor to acquire skill in his art than by resolutely working out (to him) novel problems the best way he can, even when he knows that they have been satisfactorily solved by others; then comparing his invention with the products, it may be, of older and more experienced minds. The skill so gained will tell in his favor when he strikes a problem that is entirely novel.

The other error referred to is the assumption that the inventions of young people are not likely to be of any value. The history of invention is full of illustrations to the contrary. A recent instance is recorded in a morning paper. A young lad in the Cooper Institute class in mechanical drawing has devised a simple attachment to the ordinary bath tub, by means of which any bath room is enabled to furnish every variety of baths, Russian, spray, vapor, medicated, or other, as may be desired. The *Herald* says that one apparatus has been manufactured and placed for trial in the French Hospital in this city, where it is being experimented with in the treatment of rheumatism and acute nervous diseases by spray baths permeated with drugs. The same contrivance, attached with rubber tubes to the faucets of a wash-bowl, serves to produce vapor impregnated with chamomile or other herbs for inhalation in cases of bronchial affections. A number of physicians have called to see the young inventor, and all commend the invention, but express surprise that something of the kind was not produced long ago.

That is the usual way. When an invention is made, the wonder is that no one has ever seen the way to do it before.

It is safe to say that there is not a single article in every day use that will not sooner or later be greatly improved: we do not see the opportunity now because we are blinded by habit. It requires a novel point of view to make the requirement visible; and to a large extent the keen eyes of youth, if encouraged to be critical, are best situated for taking novel views of things. And bearing in mind the truth that the most profitable field of invention, all things considered, is in connection with matters of every day use by everybody, the common custom of discouraging the efforts of young people in this direction, however crude at first, is far from wise. The habit of mentally challenging the economic right of everything in common use to fill the position it occupies, of asking what its real function is, and whether it might not be bettered or possibly displaced entirely by something cheaper, handier, or more efficient, is one of the most promising habits that the young can acquire. There is money in it, and public benefit as well.

TEMPERING STEEL.

More tools are ruined by overheating, cold-hammering, and over-tempering than can be redeemed by all the new receipts that have been invented. The only way that is really good, is first to find a brand of steel that is good and suitable for the tools to be made, and stick to it. Next find by a few trials the lowest heat that will harden it in pure water at 70°, or ordinary shop temperature. If steel is hardened at the lowest heat, the temper will require drawing very little, *i. e.*, to a pale straw, full straw, or brownish yellow, but not deeper unless for wood working tools with thin cutting edges, when a full brown may be desirable.

File makers use salt water for a hardening bath, because it makes the water more dense and the teeth harder and of course more brittle.

Sulphuric acid or mercury is sometimes used for hardening very small tools for cutting glass and etching stone.

For springs the same care should be taken in regard to low even heating that is necessary with tools. Pure lard oil is as good and probably better than any of the many mixtures that have been tried for the hardening fluid; burning off may do for drawing the temper of small or thick springs, but is totally unfit for long or slender ones.

Dip the hardened spring into a bath of oil heated nearly to its boiling temperature; this is the only way to get an even temper.

Bisulphide of Carbon Lenses.—Proportions of Lenses.

We say, in reply to a correspondent, that we do not know of any telescopes with bisulphide of carbon correcting lenses having been made of late years. They were never a success. It requires the grinding and polishing of four surfaces for the correcting lens, and as there are no formulas, to our knowledge, for the bisulphide, you will have to make an experimental trial. For your front glass, you may make the curves one to six or nearly a plano-convex flat side next the eye, the radius of shortest curve about six times the diameter of the lens. For the correcting lens, the diameter should be not less than one-third the diameter of the front lens. Its general form should be plano-concave; and as the dispersive power of bisulphide is more than three times as great as crown glass, its refractive power being about 50 per cent greater, you may make the side next the object glass plane, and the side next the eye convex on the inner side and plane next to the eye, if convenient to do so. This will require only one curve to be altered for final correction. To start, make this curve the radius of the first surface of the front lens, and place the lens about one-third the focal length of the object glass from the eye.