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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 359,

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THE TRANSIT OF VENUS.

One of the greatest astronomical epochs of the century will occur on Wednesday, the 6th of December. The planet Venus will then make her way across the sun's disk, and American observers are this time on the right side of the earth to behold the rare phenomenon. The actual sight of the transit, except for its bearing on science, possesses no special interest. It is not a glorious spectacle, like a total solar eclipse, nor a weird combination of celestial beauty, like a total lunar eclipse, nor an awe-inspiring exhibition of omnipotent power, like a grand aurora, nor a startling display of celestial pyrotechnics, like a downfall of meteors, nor a sudden apparition of a great comet sweeping the skies with its gossamer tail.

A tiny black spot will cut sharply into the sun's border, move slowly over his disk, and, after a passage of nearly six hours, will suddenly disappear. This is all that will be perceptible to the naked-eye observer. But to the astronomer and the telescopist the event is full of the deepest significance. Through its instrumentality a solution is sought of one of the noblest problems ever elaborated by the highest exercise of human reason. To measure the unapproachable, is the point at issue, and never, in any previous combat with immensity, have astronomers had at their command such resources for becoming victors in the contest. The labor demanded is of the most severe and delicate nature, even when assisted by the most perfect instruments that have been invented. The utmost accuracy is required, or the result will be a failure. Measurements must be accumulated like grains of sand upon the seashore. Thousands of observations are often required in correcting an infinitesimal error. The grand object for which nearly one hundred transit expeditions have been organized, is to acquire the right of adding or subtracting less than one-tenth of a second to the solar parallax, from which the sun's distance from the earth is deduced.

It is a work of exceeding difficulty to determine the parallax of the sun, on account of its minuteness. The problem has not yet been accurately solved, after the incalculable labor bestowed upon it; the sun's distance is far from being a certainty. The best authorities give the parallax as less than 9″, almost certainly between 8·75″ and 8·85″. But this tenth of a second that is considered doubtful, is more than a hundredth part of the whole, although, says Professor Young, it is no more than the angle subtended by a single hair at a distance of 800 feet. If we accept 8·80″ as the parallax, an estimate probably nearer the truth than any other, the sun's distance, expressed in miles, will be 92,885,000, while the variation of one-twentieth of a second will change the result either way a half million miles. The most sanguine observers will feel that they have accomplished all they expect if the uncertainty is reduced to a quarter of a million miles.

If eyes were perfect and instruments were perfect, there would still be great difficulty in obtaining the exact parallax of the sun, but the problem is complicated by the imperfection of human vision and the imperfection of astronomical instruments. Three methods of observation are employed by transit observers: the direct observation of contacts, the photographic method, and the micrometric method, which all have their special advocates. The direct observation of ingress and egress is the most simple, and is chiefly relied on by English and some French astronomers. It needs only a good telescope, two eyes that know how to observe, and a chronometer. Of the three elements, the one that is seldom found, and is the most difficult to be acquired, is the clear-sighted, practiced eye. Hence many discrepancies are found in the contact method, which, from the organization of the eye, seem to be without remedy. A practiced observer can do more with a poor instrument than a novice with the most perfect instrument science can furnish.

The photographic method was devised to make up for the inaccuracy of the eye. This forms the means of attack of American observers, although it is coming into favor with astronomers of other nations. The object is to take as many photographs of the sun with Venus on his disk as possible during the continuation of the transit, and to aim at perfection in the execution of the work. The photographs can be taken home, compared, and measured at leisure. The trouble here lies in getting pictures free from distortion, and in the accurate determination of the scale of the pictures taken by different observers.

The micrometric method is the one adopted by the Germans, and requires the use of the heliometer. But the heliometer is a difficult and complicated instrument, and will only give satisfactory results in the hands of exceptionally skillful observers.

Thus it will be seen that each method of attacking Venus during her passage across the sun is beset with difficulties, and thus sympathy cannot fail to be roused for the zealous laborers in the field, who have traveled thousands of miles to reach their stations, transported cumbrous instruments to aid in the combat, and are now hard at work in preparing for the coming of an event that may crown their undertaking with some degree of success, or that in at least half the cases will be hid from view by an overcast sky. In southern stations, where it is now midsummer, a clear sky may be anticipated at about half the observing localities. In northern stations, where it is midwinter, the average chances for clear weather are only about one in fifty. For this reason, almost all the observing parties have chosen southern stations.

The problem of the sun's distance is of paramount importance, and fully justifies the outlay of brain, labor, and money lavished on this uncertain means of reaching its solution. It is the unit or yardstick of celestial measurement, the standard by which everything outside of the earth in the material universe is measured, excepting the distance of the moon. A mistake here makes all celestial computation inaccurate, the diameter of every planet, the radius of every orbit, the distance of every star. Thus the nearest fixed star in the northern hemisphere is 61 Cygni. Its distance is estimated at about 366,000 times the sun's distance or earth's radius. This means 366,000 times 92,885,000 miles. If there be an error of half a million miles in this estimate of the sun's distance, it will readily be seen that the error in the star's distance takes on gigantic proportions.

The 6th of December will therefore be a great day on the annals of the nineteenth century. Transit observers will do their utmost to obtain a more accurate determination of the sun's distance. If they do not reach perfect success, and there is little hope of such a result, they will have the satisfaction of feeling that they are laboring in a noble cause. For the observations made during the transit of 1882 will be a rich legacy to aid the astronomers who, 122 years hence, will observe the next transit in 2004.

We can only wish for good weather and good luck to the brave adventurers, and join in the prayer of the great astronomer, Halley, who, from an observation of the transit of Mercury in 1677, at St. Helena, was the first to discover the scientific import of transits. In recommending to future astronomers a careful observation of the transit of 1761, he says, in closing:

"May Heaven favor their observations with the most perfect weather. And when they shall have attained their object, and determined as well as they can our distance from the sun, let them remember that it was an Englishman who first conceived this fortunate idea."

RURAL VIEWS OF PATENTS AND PATENT RIGHTS.

To persons unfamiliar with the natural history of the industrial arts, who know little or nothing of the incessantly varying needs of our multiplying industries; nothing of the numberless lines of progress, each impinging somewhere upon the unknown, baffled for the moment, but certain sooner or later to shoot forward the instant the needed invention or discovery is made; and whose vision of the future is clouded by ignorance made denser by prejudice and professional bias—to such persons it naturally seems impossible for the human mind to find out much more that is new. The unoccupied field of invention, which to the intelligent is boundless and barely entered upon, is to them inconceivable; at best they can figure it only as a narrow circuit in which the future must endlessly tread upon the heels of the past. A charming example of this perverted and fallacious thinking—perverted by prejudice and fallacious through almost incredible unfamiliarity with the facts involved—appears in a recent issue of the *Western Rural*. The editor, discussing "Patents and Agriculture," makes the astonishing yet characteristic assertion that "it is pretty safe to say that nine-tenths of the things patented are worth less, and equally as safe to say that three-quarters of them are unpatentable because of prior use. Judging from the number of patents in existence, it is the easiest thing in the world to discover something new. On the contrary it is one of the most difficult things. The world makes mighty slow progress. It lives itself over and over again. It adopts new methods and forgets old ones. Then somebody, following the natural bent of the human mind, happens to stumble upon some of these obsolete methods, concludes he has found something new, and applies for a patent. The lost arts will be gradually revived, as the human mind becomes tired of what it knows and seeks for something else. The mind runs too much in one groove to make it possible for all our patents to represent something new. Discoveries of new forces and principles and the invention of new applications of forces and principles are rare exceptions, and we can almost count all the prominent ones that have been made in the whole of the world's history upon the ends of our fingers, and some of these have been found to be literal imitations of what at the time was unknown in nature. We are not nearly so fertile in inventive genius as the records of the Patent Office would appear to indicate.

"But original or otherwise, patentable or not, when anything is covered by a patent it becomes a source of a world of trouble, under our patent laws, to the people."

It may be safe enough for the *Rural* to say that nine tenths of patented things are worthless, or that all of them are. It probably knows its own constituency, and there is no penalty for talking nonsense save loss of favor among one's friends. To say it, however, betrays a recklessness with respect to truth or an ignorance of the actual outcome of inventions that we should not have believed possible in these days of general popular intelligence. And each and every one of the dozen or more assertions in the rest of the paragraph we have quoted is equally wide of the truth—flagrantly and ridiculously wide of the truth. One and all, they betray a perversion of view, a misreading of the plain evidences of fact, a misunderstanding of the conditions of invention, a misstatement of the effects of patented inventions upon public peace and wellbeing, that cannot be attributed solely to prejudice and misinformation.

The little world the *Rural* writer lives in must certainly make "mighty slow progress;" but how it is kept from touching at some points upon the real world that does move, and move rapidly, is a mystery which we will not attempt