

THE OPPOSITION OF MARS IN 1907.

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A favorable opposition of Mars is an event which occurs at such rare intervals as to make it one of unusual value to the astronomer. This is especially the case at the present time, when speculations are rife respecting the surface markings of this interesting planet. We are assured by the astronomers that some of them are of a permanent character, while others undergo periodical changes. The alternate appearance and disappearance of white patches at the polar regions suggest the presence of ice and snow, and therefore of an atmosphere, which renders life not only possible, but highly probable. It should be noted, however, that, on account of the greater distance of the planet from the sun, the light received by Mars is very much less than the earth receives, although its heat from recent measurements cannot be much below that of the earth. It should also be remembered that the diameter of Mars is not much greater than one-half that of the earth. There are indications which are interpreted by some as explainable by the existence on the planet of intelligent beings. Should such exist, we are naturally led to reflect upon the geography and landscape of the planet as compared with those of our earth. But the purpose of this paper is not to discuss these speculations, but to exhibit graphically the peculiarly favorable conditions under which the astronomer will labor during the month of July, 1907.

The ability to observe a planet satisfactorily obviously depends very much upon its proximity to the earth. The distance between the earth and Mars varies between very wide limits. This is due to the great eccentricity of the planet's orbit, which is second only to that of Mercury.

The accompanying drawing is a plot of the orbits of the earth and Mars; and while they are elliptical, the difference between the lengths of the major and minor axes in each case is scarcely noticeable in a plot of these dimensions. But the eccentricity of the orbit of Mars is between five and six times that of the earth, which accounts for the great variation of the distances between the two planets at different oppositions. The center of the sun is represented at *S*. Through this point is drawn *PA*, the major axis of the orbit of Mars. *P* represents the perihelion, and *A* the aphelion of the planet.

In order to obtain a clear understanding of the precise relation between these orbits, the reader should realize that the earth's orbit is represented in the plane of the paper; while the orbit of Mars is inclined to it at a very small angle (nearly 2 deg.). That part of the orbit of Mars which includes aphelion, viz., *b A c*, is supposed to be above, while the remaining portion, viz., *c P b*, is supposed to be below the paper. The line *bc* is the intersection of the planes of the orbits of the two planets.

The positions of the earth and Mars are represented at different dates beginning January 5. Straight lines representing the distances between them are drawn connecting the centers of the planets at nine corresponding dates, viz., January 5, March 2, April 27, June 22, July 6, 13, 20, September 14, and November 9. The greatest possible distance would be reached if Mars were at conjunction and aphelion at the same date. This distance, represented by *aA*, is equal to the entire diameter of the earth's orbit ($=ae$) increased by *eA*. The least possible distance between the planets would be reached if Mars were at opposition and perihelion on the same day, i. e., if Mars were at *P* and the earth at *a*. It is represented by *aP*, and is equal to the minimum distance between the sun and Mars ($=SP$) diminished by the radius of the earth's orbit.

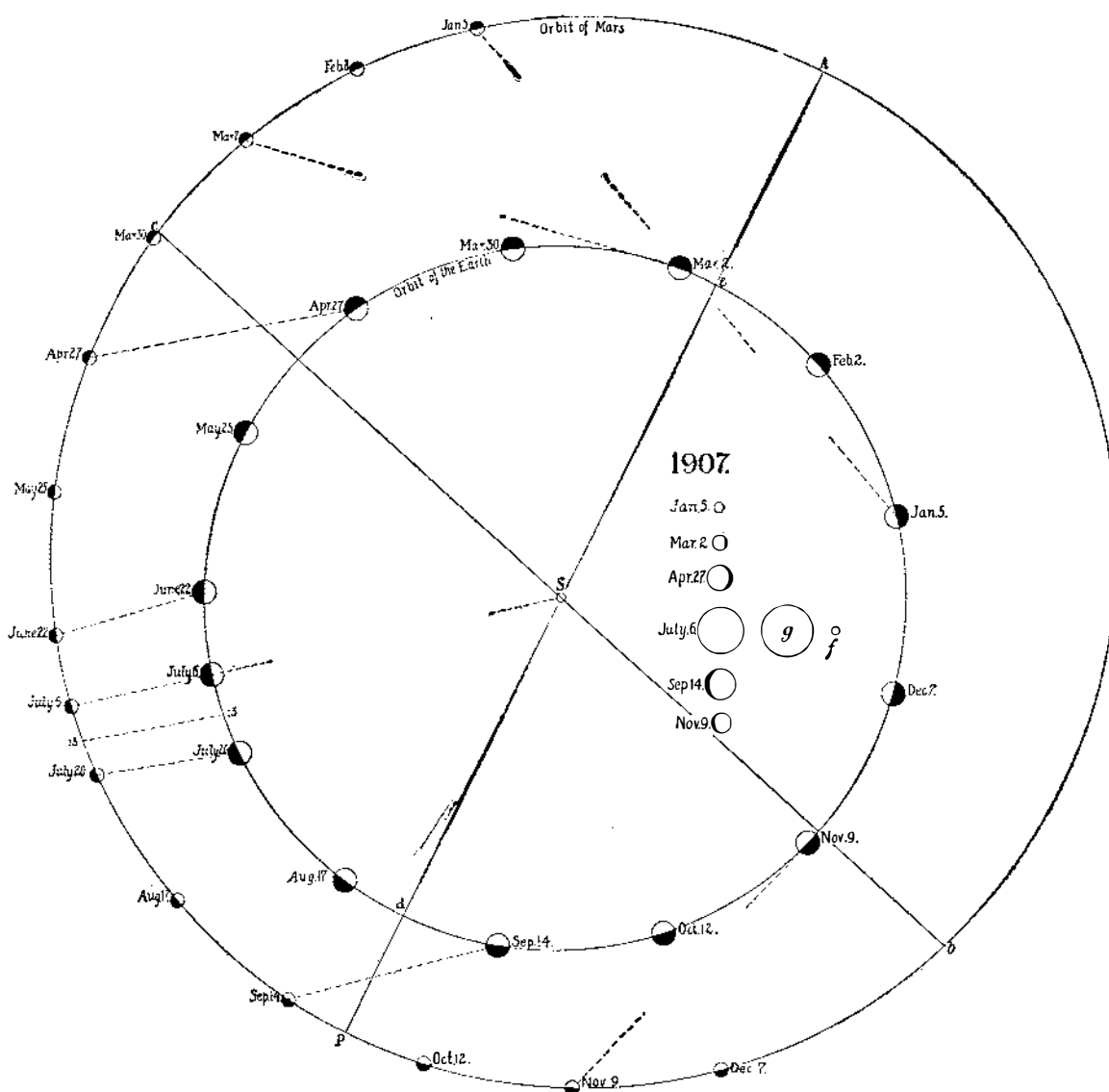
Some of the variations in the apparent diameter of Mars between these extreme possible positions are represented within the plot of the earth's orbit at six

dates of next year; and in each case the illuminated and shadow surfaces of the planet are indicated. The reader will readily determine the position of the dark surface prior to July 6; and will see that its position is changed after that date.

If the small circle *f* be taken to represent Mars when at that conjunction which is most unfavorable for observation, i. e., when the earth is at *a* and Mars at *A* (the greatest possible distance), the circle *g* will represent him at the opposition which is most favorable for this purpose, i. e., when the earth is at *a* and Mars at *P* (the least possible distance). The circle *g* is more than seven times the diameter of *f*, or more than fifty times the area.

The opposition which is most unfavorable for observation would occur if the earth were at *e* and Mars at *A*. In this position Mars would be represented by a circle a little smaller than that dated September 14 within the plot. The reader will readily convince himself of this by comparing the distances between the planets. The measurement *eA* is a little greater than that representing the distance between the earth and Mars on September 14.

By a comparison of the dates the reader will observe the gradual approach of the earth to Mars during the first six months of 1907, and their gradual separation during the latter part of the year. On July



THE RELATIVE POSITIONS OF MARS AND THE EARTH DURING THE YEAR 1907. OPPOSITION OCCURS IN JULY.

6, when opposition occurs, the sun, the earth, and Mars, in the plot, are in the same straight line; and at first sight we may be disposed to say that the minimum distance will now be reached; but on a careful examination we discover that, owing to the great eccentricity of the orbit of Mars, and the consequent diminution of his distance from the sun, the shortest distance from the earth will be reached a week later, i. e., July 13, when the earth will have gained upon Mars about $2\frac{1}{2}$ deg. On July 20 the distance between the planets will differ a very little from that of July 6, when the earth will have gained nearly 5 deg. on Mars. During this period of two weeks, viz., from July 6 to 20, the apparent comparative diameter of the planet will be represented by the circle opposite the date July 6 within the plot. If we compare it with that marked *g*, we see that its diameter will not differ very much from that which it would attain if the planet should reach its apparent maximum size. The difference is in the proportion of 65 to 72, or about eight-ninths.

An examination of the great variations in the apparent diameter of the planet, together with a consideration of the intensity of the light received and reflected when it is at its maximum distance from the sun and earth, as compared with the amount received and reflected when these distances are reduced almost to a minimum, will convince the most casual

observer of the peculiarly advantageous position of Mars relative to the earth during the month of July, 1907.

RAILWAY ACCIDENTS AND SURGERY.

Despite the institution of the most elaborate precautionary and disciplinary methods, the railroad operator, owing to the nature of his calling, is necessarily exposed to accidents and fatalities. According to the latest available returns upon this subject, no less than 3,632 men were killed and 67,067 injured during the course of a year upon the railroads of the United States. In Great Britain the calamity returns are considerably lighter, despite the congested nature of the railroad traffic, the fatality roll aggregating 416 killed and 6,590 injured. In this country one man out of every 357 is killed and one in 19 injured. In Great Britain the percentage is considerably lower, the proportion being one in every 10,144 killed and one in 747 injured. Upon the railroads in the latter country ambulance corps have been inaugurated among the operatives for the express purpose of succoring their injured comrades. The railroad operator, no matter in what path his duties may lie, is ever confronted by danger in a wide variety of forms. At the same time, many injuries have proved ultimately fatal, because of the long period of time that has elapsed between

the time of the injury and the arrival of the doctor; whereas had first aid been rendered, the life might have been saved, or at any rate the extent of the injury appreciably minimized, by the successful prevention of subsequent complications. In this country the effect of such delay is particularly marked, owing to the great distances separating points at which medical aid can be obtained. More than once, when a man has been injured during the journey of the train, he has had to lie unattended for an hour or two, so that when the surgeon received the case, the effects of the accident had so developed that the possibility of saving the life had become very remote.

Realizing this salient point, the employees on the Boston and Maine Railroad have adopted the movement in vogue among British railroads, and have inaugurated a means whereby the rendering of first aid to the injured may be taught among the numerous operatives.

The scheme was originated by the Railroad Branch of the Boston Young Men's Christian Association, and when it was brought before the directors of the company, its widespread benefits were immediately realized. The

authorities forthwith sanctioned the idea, and decided to defray the cost of initiating the men into first-aid work, the task of drilling the men being devolved upon Dr. H. H. Hartung, who is an active member of the National First Aid to Injured Society. Among the men too the scheme was warmly received, and the whole of the employees are being made proficient in the art of succoring the injured. The large shunting yards are the scenes of the greater majority of accidents, and the railway authorities have shown practical sympathy with the movement by the establishment of emergency stations, replete with every appliance necessary to render first aid, and to which the injured can be carried to await the arrival of the doctor. The greater part of the injuries received by railway men comprise fractures, contusions, crushings of various parts of the body, burns and scalds, and in some instances the supervening of blood poisoning within a short time of the accident, owing to the entrance of some foreign substance into the wound.

"Any surgeon will tell you," states Dr. Hartung, "that nearly everything depends upon the skillful and successful treatment of an injury immediately after it has been inflicted. Many an accident which is comparatively trivial in nature develops seriously, owing to the shock the system has incurred before the practitioner arrives. For instance, take a compound fracture. Many a poor fellow struck down has lain in