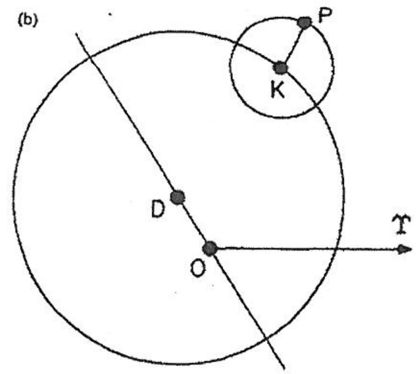

Fig. 8. Two versions of an intermediate model for Mars. There is no separate equant point. But the center D of the deferent may be displaced one way or the other along the line of symmetry in the pattern of the planet's retrogradations. In Fig. 8(a), D has been displaced in the direction of the 1971 retrogradation. In Fig. 8(b), D has been displaced in the direction of the 1978 and 1980 retrogradations.

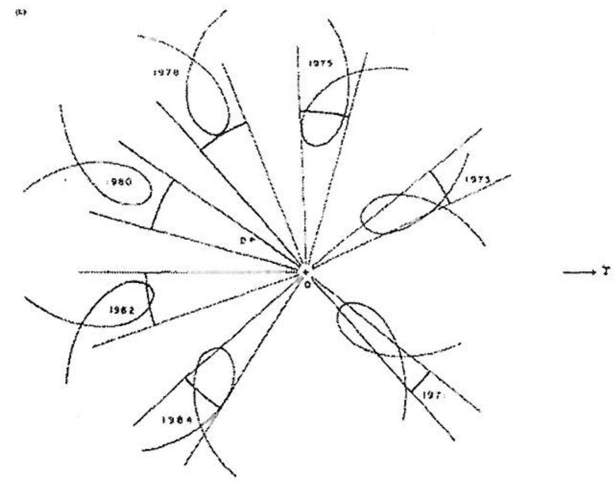

Fig. 9. Comparison of an intermediate model with the real motion of Mars. The Earth is at O, the center of the deferent at D. (a) The model represented in Fig. 8(a). (b) The model represented in Fig. 8(b).

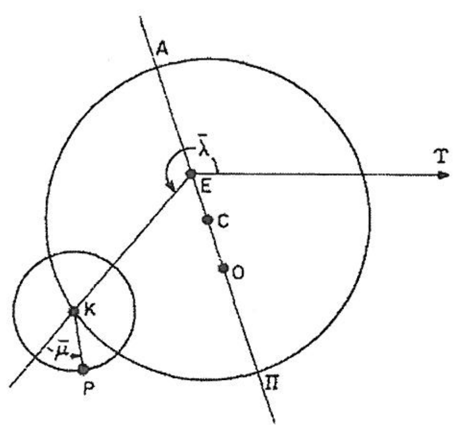

Fig. 1. Ptolemy's theory of longitudes for Venus, Mars, Jupiter, and Saturn.

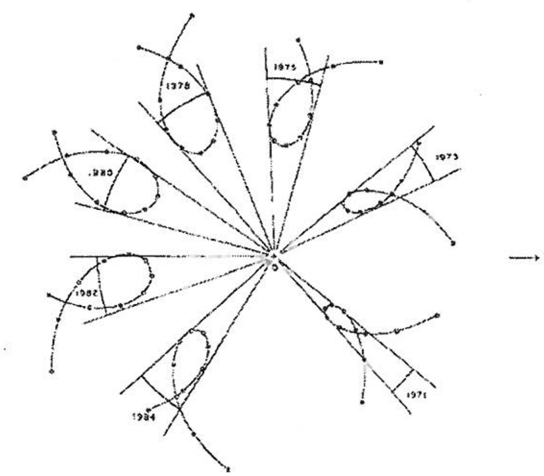

Fig. 10. Comparison of the Ptolemaic theory for Mars with the actual retrograde arcs of the planet between the years 1971 and 1984. The numerical parameters of the model are not Ptolemy's but have been determined anew by applying Ptolemaic procedures to modern data.

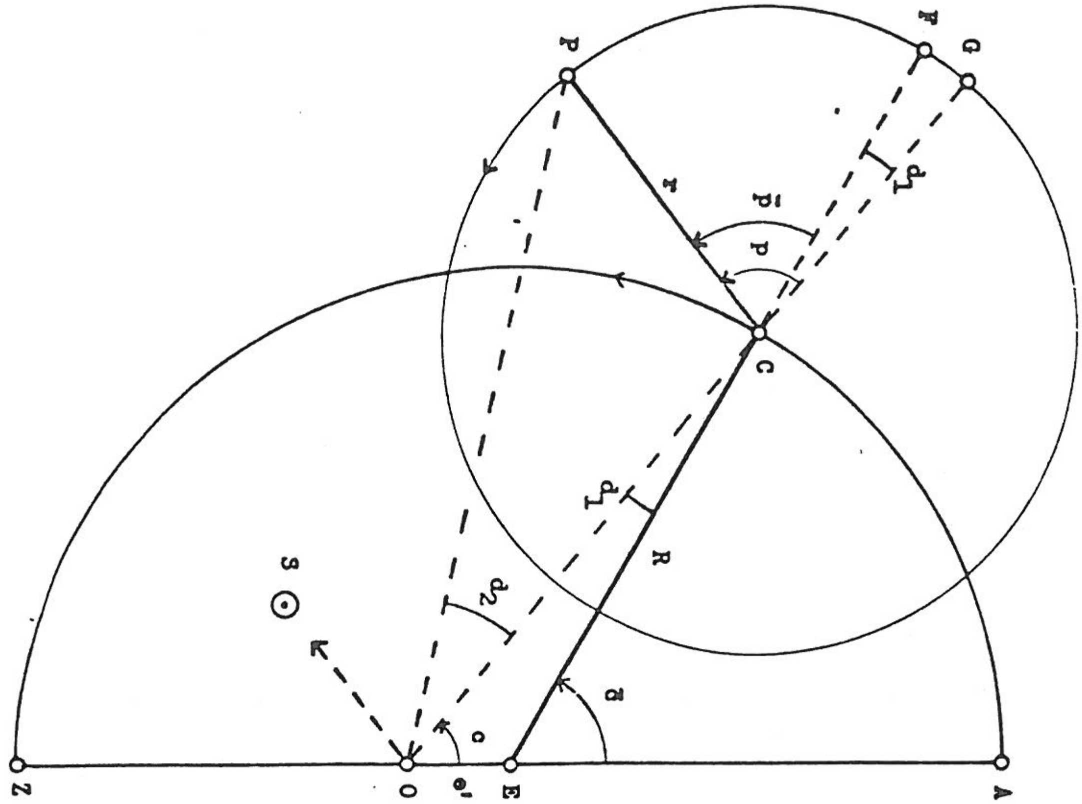

Figure 9

Provisional eccentric model drawn to scale for Mars. The center of the epicycle C moves on a circle with center E removed from O by an eccentricity e'. Consequently, the mean motion $\bar{c}$ of C now takes place about E, and the mean anomaly $\bar{p}$ of P is measured from the mean apogee of the epicycle F on line ECF. The true motion c and true anomaly p as seen from O are found by adding or subtracting the equation of center d_1, a purely optical correction. The eccentricity also causes the distance OC to vary between R + e' and R - e', affecting both the apparent direction of the planet as seen from O and the length of the retrograde arc which is now variable. However, Ptolemy found that this model still cannot satisfactorily reproduce the retrograde arcs of Mars.

Figure 13