velocity of over a thousand miles an hour (about 750 on his smaller globe). If the earth were rotating at this furious speed, Ptolemy reasoned, there should be a terrific gale, much as if you stuck your head out the window of a jet plane. No such wind was apparent, so the earth stood still and everything else went around it. Ptolemy sensed that there was something whacky about the whole arrangement, but it was the best he could do with the evidence at hand.

Now a stationary earth works as well as any other kind – almost. Of course, there were some engineering problems involved, such as how the host of heaven got around the earth every day which would involve speeds infinitely greater than the mere 750 that had bothered him. But at least they were remote, and he had taken care of the problems at hand which is what all good politicians have learned to do since. There was only one really serious difficulty: the problem of the planets.

The Maladjusted Planets

Since men began to observe the stars in the remote past, it was noticed that the host of heaven marched past in the night in perfect order, each star maintaining its place within its pattern (constellation) faithfully from year to year (although the heavens aren't changeless over the ages). However, there were a few bright and conspicuous stars that were a law unto themselves; they appeared to wander among their fellows. You would find one as an intruder in a given constellation now, and a few months later it would have moved on into another. Hence, their name planeta, which means wanderer.

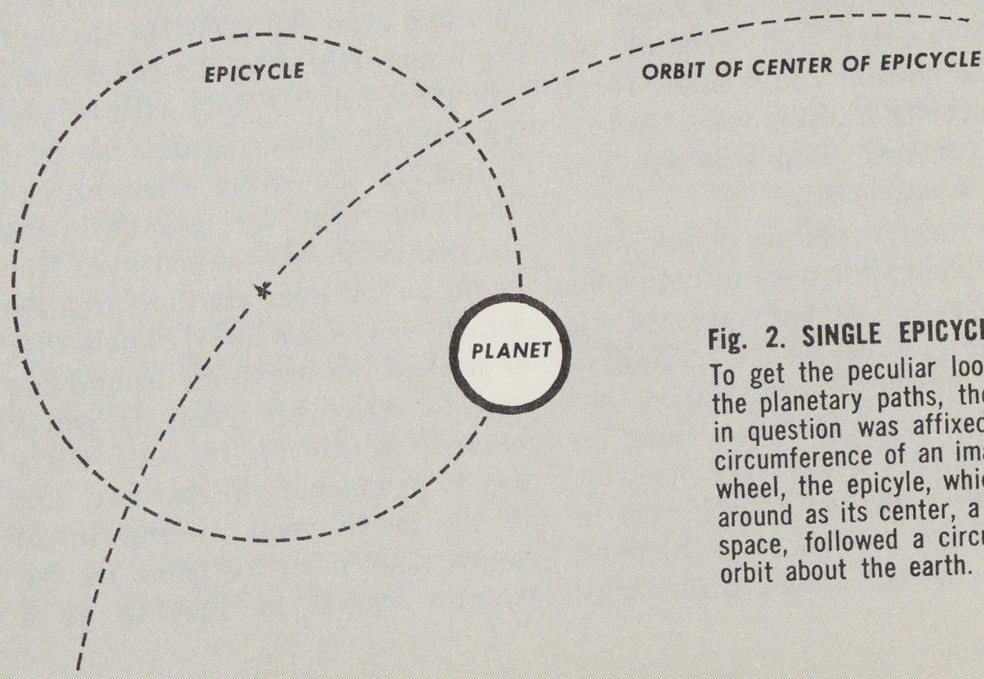

Fig. 2. SINGLE EPICYCLE.
To get the peculiar loops in the planetary paths, the planet in question was affixed to the circumference of an imaginary wheel, the epicyle, which turned around as its center, a point in space, followed a circular orbit about the earth.

Now fitting these maladjusted members of the celestial family into his cosmic scheme was no easy assignment, since they not only slowly strayed where they would, but even executed weird loops in their paths among the stars on occasion. But Ptolemy was equal to the task. The Greeks had decreed that all orbits should be circles, since a circle was the symbol of perfection, so Ptolemy was stuck with that figure.

However, there was no limit to the number of circles he could use; they weren't rationed. He, therefore, put his planet – Mars, for example – on the periphery of a second circle whose center, an imaginary point in space, followed a circular path about the earth as in Figure 2. The scheme, although a little complicated, worked quite well as should be evident from Figure 1. The apparent path of a planet as the consequence of this double motion was looped at intervals which is exactly what happens – or at least appears to happen – periodically in the heavens. So far so good.

Complexity Ad Absurdum

However, there was still one little catch to the whole arrangement. If an astronomer tried to project the system into the future and predict the position of a planet for some night years ahead, he was always in error. But that could be remedied. Why not a double epicycle as in Figure 3? The planet in question was now mounted on the circumference of an imaginary second orbit, whose center followed a circular path whose center in turn went about the earth. Now that ought to do it. It should have, but the more involved system didn't quite work either. But still astronomers didn't give up hope, perhaps other epicycles revolving on the previous ones would secure a better fit.

In the ensuing centuries that elapsed before Copernicus and Kepler straightened out the celestial tangle in the sixteenth and early seventeenth centuries, industrious scholars complicated the theoretical structure beyond belief. Still, the computed paths, the theory, did not fit the facts of observation for very long into the future. The planets soon got out of order no matter how involved the system became. Arabian astronomers carried on while the