ciently accurate were not to be had, it was suggested the only choice was to work out in advance, and tabulate the exact angular distances, at a first meridian, between the moon and some well known stars. These distances were to be reduced to what they would be if seen at the earth's center, and to be arranged for any hour of observation. Now as the angular distance between a star and the moon is necessarily the same at the same moment of absolute time, if that distance be observed at the same instant from two stations not in the same longitude, the only difference in the observations will be that of so many hours of local time, according to the distance apart the two stations may be. And when from such difference in time, the difference in space is worked out in the ratio of 15 deg. to an hour the correct longitude is obtained. Charles the Second was informed in 1674 that such tables of lunar distances, if prepared in advance, would be of great value to English seamen. He referred the question to a commission, John Flamstead was known to one of the commissioners, and was consulted on the subject. The King learned, from Flamstead, no accurate data for such tables existed, and that the positions of available stars for such a purpose were nowhere catalogued with sufficient exactness to be of any service. The result was Greenwich observatory was founded and Flamstead was appointed Astronomical Observator, finding his own instruments, and receiving the munificent salary of £100 a year. He determined with great accuracy the positions of about three thousand stars, and made a large number of lunar observations. In 1724, five years before Flamstead's death, an act of Parliament was passed offering five thousand pounds reward for a set of tables which would give lunar distances to within 15 sec. of arc; such tables to be tested by comparing them with actual observation for a period of eighteen years and a half. Mayer, of Gottingen, worked out a set of tables and sent them in 1775 to be tested for the award, but died soon after at the age of 39. The *Nautical Almanac* was started in 1767, Mayer's tables being used in it. His wife received £3,000 of the award offered, and a like sum was given to Euler, whose essay containing the solution of the celebrated problem of The Three Bodies had, in 1748, received the prize of the French Academy. Euler's famous problem was: given their distances, velocities, masses and direction, what will be the path of one of three bodies around another, when all move in accordance with the law of gravitation?

The lunar method of finding longitude has fallen into disuse since the days of chronometers. For these we are indebted to John Harrison, a Yorkshire carpenter, who, I fear, would have utterly failed at a grammar school examination, but whose ingenuity in constructing a timepiece not affected by climate was nevertheless of inestimable service to his country. As his chronometers had the accuracy called for by the act of Parliament we before referred to, he received from the English Government in 1767 £20,000.

In the British *Nautical Almanac* lunar distances of several of the best available stars and planets east and west of the moon, may be found to a second of arc, by simple inspection, for every third hour of Greenwich time, with a simple method of estimating the difference for any intervening time. There is also given, for the same purpose, a list of moon culminating stars. The lunar distances are complete from Hansen's Lunar Tables of 1857; and are published in the almanac more than three years in advance. The precision with which the position of a ship at sea can now be determined was shown by the picking up from the bottom of the ocean, of the broken Atlantic cable, no larger in section than a ten cent piece; as all the buoys had been washed away, and nothing was left to the navigator to guide him in what looked so hopeless a task but his nautical skill to find the exact spot where the break had occurred.

Simultaneously with the advancement of lunar investigations in this direction much progress was made in the work of scrutinizing and mapping out the moon's surface. Without instrumental aid, only a faint indication of the more prominent objects on the moon's disk can be seen, and one is not surprised that some of the early selenographers thought these were but the reflected seas and continents of the earth. Galileo's 'perspective glass,' made by him about 1609, was the first known medium through which anything more than this was seen. He published his observations the next year. The quaint title of his book tells its own story, and is worth giving in full: "'The Sidereal Messenger,' announcing great and wonderful spectacles, and offering them to the consideration of everyone, but especially of philosophers and astronomers, which have observed by Galileo Galilei, etc., etc., by the assistance of a perspective glass, lately invented by him, namely, in the face of the moon, in innumerable fixed stars, in the milky way, in nebulous stars, but especially in four planets which revolve around Jupiter at different intervals and periods with a wonderful celerity, which hitherto not known to anyone, the author has recently been the first one to detect and has decreed to call the "Medicean Stars." He constructed the first lunar map, and in a rough way calculated the height of some of the lunar mountains, to which his method gave too great a height. It is thought his first telescope could not have magnified more than seven diameters, and it is said to be beyond doubt he never used an instrument which magnified more than thirty diameters.

The "Selenographia" of John Hevel, or Hevelius, appeared in 1647. It marked an era in lunar discovery. Hevel was an extraordinary man. He made his own instruments, engraved his own maps and printed his observations with his own hands. His telescope magnified from thirty to forty diameters, and from the observations he made with it he constructed a map, showing two hundred and fifty lunar formations. For more than one hundred years Hevel's map remained the best map of the moon. The chief lunar formations he named after the earthly formations to which he fancied they bore the closest resemblance. Six of his names—the lunar ranges of the Alps and Appennines, and four promontories—are still retained. He discovered the moon's libration in longitude.

Telescopic observation, though with low powers, soon made it plain, from the same features being always apparent, that the moon had an axial rotation, and takes the same time to turn once round she takes to complete her circuit round the earth, and that these two movements keep almost the same half of her sphere always turned towards the earth. I say almost, because, as Hevel discovered, even the moon does not always show exactly the same face. She appears to gradually swing forward and as gradually to withdraw, first in one direction and then in the other, portions of the side of her sphere turned from us. The maximum measurement of this part of her sphere thus brought to view is about 7 deg. 53 min. of lunar longitude, equal to about a forty-fifth of her circumference. There is a similar change, though to a somewhat less extent, in latitude. This apparent shifting to and fro of the center of the moon's disk is called her libration in latitude and longitude. Libration in longitude arises from the time of the moon's axial rotation being always the same, while her movement of translation in her elliptic orbit varies with the change of distance from the earth. Thus, as the moon moves faster or slower in her orbit of translation, her equable axial rotation brings to our view east and west of her disk, portions of her sphere not seen when she is at her mean distance from the earth.

Libration in latitude is caused by the inclination of the planes of the lunar equator and orbit to the plane of the orbit of the earth; similarly the inclination of the axis of the earth causes the