

the preliminary notice it appears that his apparatus has given an important addition to our knowledge of the solar radiation and of the atmospheric absorption at that place. This portable compensation pyrheliometer, with rheostat, small galvanometer, electro-dynamometer, and Leclanche cell, packed in a box 16 inches high, 10 inches wide, and 5 inches deep, weighs, with its tripod, 15 pounds, and is so arranged that it can be set up for use in a very few minutes. Angström's apparatus is equally applicable to the measurement of the radiation from very feeble sources of heat, such as a lamp or a warm block of stone or metal, and is peculiarly valuable as a means of determining the constants of the bolometer or thermopile.

THE USE OF THE DIVINING ROD IN THE SEARCH FOR WATER.

According to the *Scientific American* for April 7, 1900, a commission has been appointed in France to study all apparatus and methods employed by sorcerers, water seers, and wizards, who use the divining rod, mineral rod, exploring pendulums, hydroscopic compasses, and the other instruments which go by a host of other fanciful names. The French engineer, M. Borthier de Rollière, is the president of the commission. He will procure divining rods of all kinds, including books, reviews, journals, reports of experiments, together with the names and addresses of the inventors of the alleged devices. All the facts and documents may be sent to M. de Rollière, care of *Cosmos*, 8 Rue François Premier, Paris, France. It is to be hoped that the findings of this commission will, once for all, settle the question of the divining rod, not only for the discovery of water, but also minerals. In England, particularly, the water diviner plies his lucrative profession without legal interference, and strange to say, his dupes are often town authorities. The whole business is akin to that of the fortune teller, the spiritualist, or any other charlatan, and it is strange that the exponents of such systems are allowed to pursue their avocations undisturbed by fear of prosecution. At present the victims are the only ones punished.

TIDES IN THE OCEAN AND THE ATMOSPHERE.

The Editor has from time to time received requests for a satisfactory popular explanation of the manner in which the attractions of the sun and moon produce tides in the ocean, and why it is that similar gravitational tides in the earth's atmosphere are not observed. Such an explanation has been in manuscript for several years, undergoing the emendations of critics who are familiar with the subject, and will, we hope, when published, satisfy the desires of our correspondents.

Of late years special attention has been given by eminent meteorologists and physicists to the proper explanation of the periodic variations in atmospheric or barometric pressure, known as the diurnal, semidiurnal, and terdiurnal periods. It seems to be agreed that these do not owe their origin to any action of solar or lunar gravitation, but that they may be the result of solar heat which expands the lower atmosphere and maintains a so-called diurnal wave of temperature in the atmosphere which gives rise to a wave of elastic pressure. Such a pressure wave would run around the earth in twelve hours, if the average temperature of the air were -5° C., whereas the temperature wave goes round once in twenty-four hours. Therefore, a stationary free pressure wave would be maintained by the forced temperature wave and produce both diurnal and semidiurnal barometric oscillations. If the temperature of the atmosphere were higher than at present the rate of wave progress, for the free

wave, would be less than now, and there might be a temperature at which the diurnal and semidiurnal oscillations would be much greater than at present.

When we study the geographical distribution of the barometric oscillations we find them varying with latitude and longitude, and especially with the continental or oceanic position of the stations. This is plausibly due to the fact that wave progress varies with temperature and pressure, but especially with the depth of the oscillating liquid. In this respect there may be much analogy between the motions of limited portions of the atmosphere and limited portions of the ocean. On a preceding page we publish a memoir by Mr. Rollin A. Harris, of the Tidal Division of the United States Coast and Geodetic Survey, in which he shows how local oscillations of restricted portions of the ocean, similar to the seiches of the Swiss lakes, can affect the general oceanic tidal wave and produce the actual tides that are of importance to navigators, while the principal tide in mid-ocean is comparatively small. The memoir of Mr. Harris is worthy of consideration by those engaged in studying periodic barometric oscillations.

SOLAR SPOTS AND TERRESTRIAL PHENOMENA.

According to an article by Dr. J. Halm, published in *Nature* March 8, 1900, it may be possible that the sun spots are an index to the existence of what may be called cosmic forces that have to do, not only with the magnetic storms and the aurora on the earth, but with minute disturbances in the annual motion of the earth around the sun. As is well known the solar spots had a minimum near the middle of the eighteenth century. Since that time the eleven-year periods have been well marked, but the intervals of minima and maxima have varied considerably; there was a high maximum in 1783, a low minimum in 1816, a high maximum in 1838, a moderate minimum in 1861, a small maximum, 1873, and a low minimum in 1888. By comparing the irregular changes in the obliquity of the earth's orbit with the curve of sun spots Dr. Halm finds three maxima and minima, viz, those of 1780, 1815, and 1840, and perhaps other smaller ones, clearly recognizable in both curves, and he states that after taking account of this new disturbing force, due to solar spot activity, the observed values of the mean obliquity are brought into entire agreement with the deductions of planetary theory based on Newton's law of gravitation. He adds that exactly the same peculiarities appear in the variations of all the other elements of the motion of the earth; they all show well-marked periodic fluctuations closely agreeing with those of the great spot period. This connection suggests to him that this solar force, which thus seems to modify the law of universal gravitation and the action of the sun upon the ellipsoidal excess of the earth's mass, may also affect the latitudes of places on the earth, that is to say, the position of the earth's axis within the earth. The recent investigations of Chandler into the variations of latitude when compared by Dr. Halm with the sun spot curve show that—

The radius of the circle described by the pole of instantaneous rotation is greatest at times of sun spot minima and smallest at times of maxima. This correspondence holds true for the whole interval of sixty years now covered by Dr. Chandler's investigations * * * the latitude phenomena lagged behind the spot curve by about 1.5 years. * * * Sir Norman Lockyer discovered that a similar lag can be traced in the curves representing the changes in the lines widened in sun spot spectra during a spot cycle; the maxima and minima of the spectroscopic curves, so far as the observations go, show a perfect synchronism with those of the curve of latitude variation.

Dr. Halm says:

We are, it seems to me, fairly warranted in assuming the force acting in such a peculiar way on the motion of the terrestrial pole to be