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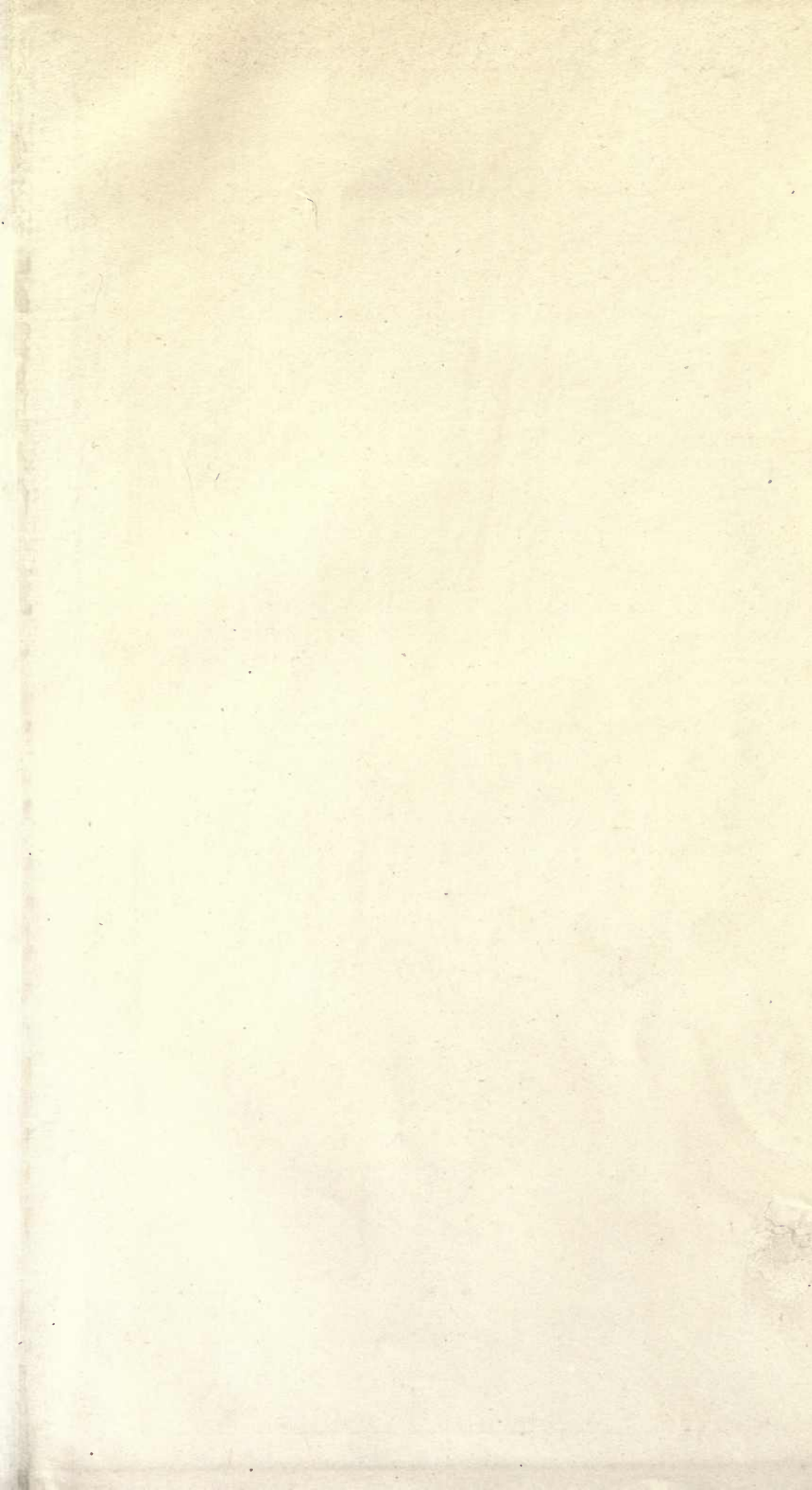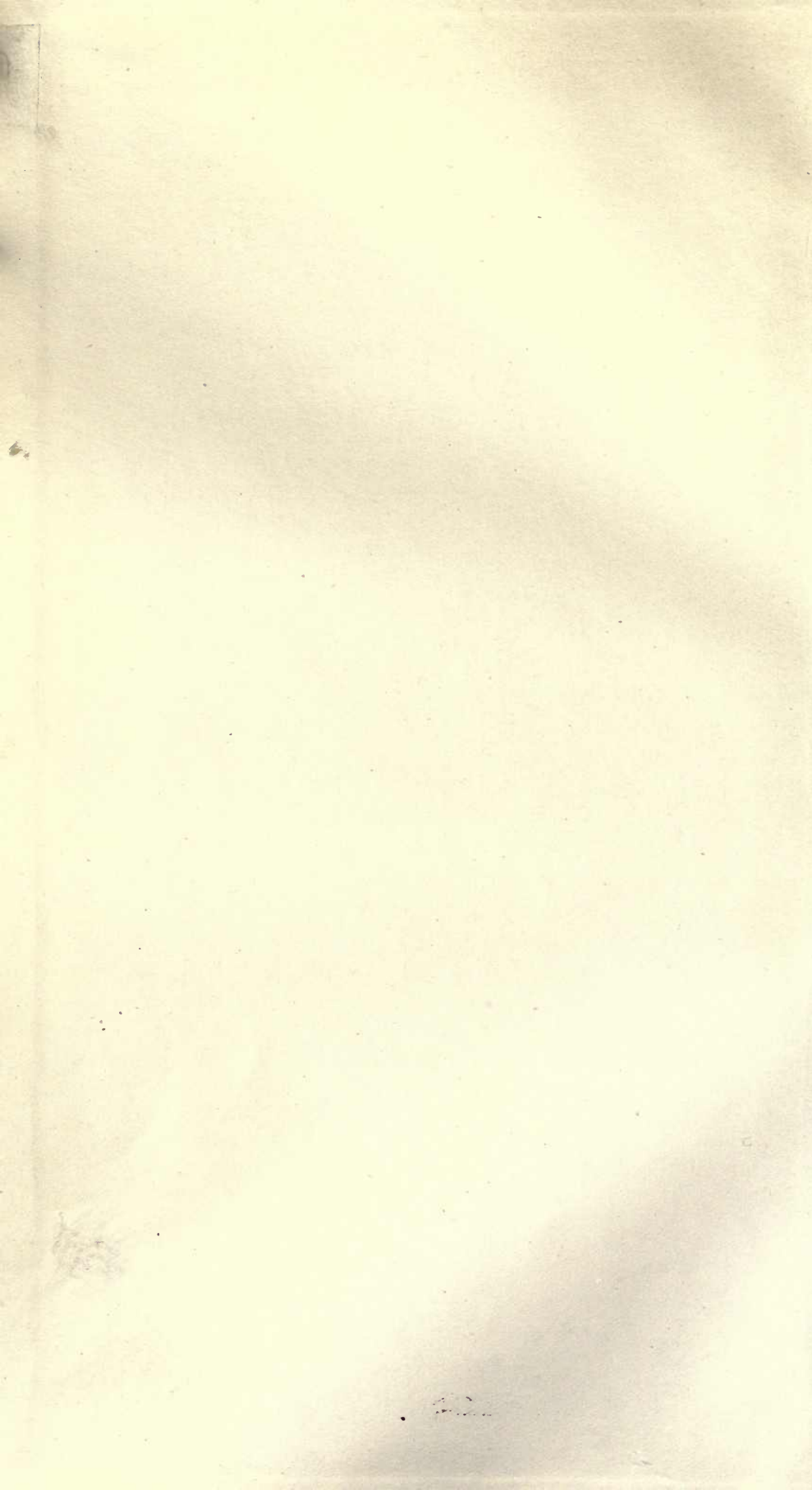
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A KINETIC UNIVERSE

EMBRACING

1.—Gravitation a Central Force :—weight increases as the centre of the Earth is approached, all the way to the centre.

2.—The Sun's Light and Heat is Mechanically derived from a reciprocating movement of its constituent Material and Magnetic Fields or Globes, of World-wide or Orbal dimensions, these movements constituting the Sun an Electro-Magnetic Dynamo whose field and armature reciprocate about each other in 1.1 second of solar time.

3.—Movements of the Fluids of the Earth, under gravitation of the Sun, Moon and Earth are the cause of Precession and Nutation.

4.—The Atmospheric and Oceanic Circulation, including the Tides, are of Precessional and Nutational character, and due to Precessional and Nutational forces.

5.—The Circulation of the Atmosphere and Ocean is due directly to Gravitation of the Sun, Moon, and Earth, and not to thermal convection as heretofore supposed.

6.—The Oceanic Tides, semi-diurnal and diurnal, are due to the eccentric positions of the fluids of the Atmosphere and Ocean about the Earth, giving rise to gravitational perturbations by the Sun and Moon.

7.—The Monsoon winds and Monsoon oceanic currents are due to the eccentric positions of the fluids of the Atmosphere and Ocean, acted on by solar and lunar gravitation; with special reference to such action on the equatorial protuberance of the Atmosphere and Ocean, and the eccentric position of the Indian Ocean.

&c., &c., &c.

DUNDEE,

1903,

JOHN JONES, AGE 50.

Discoverer of the Magnetism of the Sun and the Electro-Magneto-Kinetic, or Mechanical Source of the Sun's Light and Heat. Author of this Treatise, "A Kinetic Universe." Born at Benthall, Broseley, Shropshire, February 5th, 1851.

ATMOSPHERIC CIRCULATION,

OCEANIC TIDES,

PRECESSION AND NUTATION,

BY

JOHN JONES.

GRAVITATIONAL THEORY

OF THE

ATMOSPHERIC CIRCULATION

BAROMETRIC AND WIND THEORY

OF THE

OCEAN TIDES AND CURRENTS,

And Subordination of the Precession of the Equinoxes
to the Movements of the Atmosphere,

More particularly, a direct action gravitational theory of
the circulation of the atmosphere, barometric pres-
sures and winds, assigning these to gravitation of the
Sun, Moon, and Earth, in contradistinction to the ther-
mal views now prevailing, which assign the winds to the
Sun's heat and thermal convection ; and a subordination
of the Oceanic Tides and Precession of the Equinoxes to
pressures and movements of the atmosphere acting on the
waters, and Earth's surface, in contradistinction to the
direct action gravitational theory now prevailing,

BY

JOHN JONES,

Author of "The Sun a Magnet," "New Selenography,"
"Coral Theory of the Lunar Structures,"
"The Sun a Dynamo," "Gravitation a Central Force,"
&c., &c., &c.

DEDICATED

Not to those persons who sit in the seats of learning, and say "We are the men, and wisdom is dead without us," and who, closeted in their laboratories, deny the prevailing opinions, that the Moon can affect the weather, but to the common people, who believe the latter, and even the so called vulgar, and to all with free unfettered minds, from whom shall arise students at liberty to embrace the newer truths.   We cannot teach those who think that they know, and are wedded to false systems, but there is always hope of the rising generations.   And as " Justification by Faith" proclaimed by Luther reformed the religious world, so shall *gravitation a central force* reform the scientific world, and the *atmospheric circulation due directly to gravitation and tidal forces,* vivify the science of meteorology, and evolve order out of chaos, in this department of science.

Brave Boy!

ARGUMENT.

1.—The winds of the atmosphere have cosmical source.

2.—If the Earth were not influenced by external bodies, the atmospheric circulation would cease to exist.

3.—The influencing body is either the sun or moon, or both combined.

4.—The winds are not due to thermal convection resulting from the sun's heat and polar cold, for in that case they would at the base of the atmosphere, flow from the poles to the tropics, which they do not, but in the reverse direction.

5.—The winds are not due to thermal convection, resulting from the sun's heat and polar cold, for in that case the highest barometer would be in the polar regions, and the lowest in the tropics. The reverse is very markedly the case, the barometer in the tropics averaging over 30. 0 inches, and near the Arctic circles averaging considerably less than 29. 3 inches. The maximum in the calm zone of Capricorn exceeds the minimum near the southern Arctic circle on the average more than 1.0 inch of the barometer, while the pressure in the calm zone of Cancer exceeds that of latitude north 65° by ·45 of an inch. See Table argument 115.

6.—The winds are not due to thermal convection resulting from the sun's heat and polar cold, for in that case, with the sun in the equator, at the base of the atmosphere they would posess the greatest east to west velocity on the line, and the calms of the doldrums be unknown. On the equator the winds either average calm, or blow from west to east, with the oceanic counter current of this direction flowing on or near the line.

7.—The winds are not due to thermal convection resulting from the sun's heat and polar cold, for in that case they would blow steadily, which they do not, but on the contrary are very variable, and would not develope steep barometrical curves, elevations, depressions, and storms. If the winds were thermal the contrasts of pressure which develope storms could not exist. Even night and day contrasts of temperature are unable to develope storms, the calm of the evening where the contrasts are strongest being proverbial.

8.—The winds are not due to thermal convection resulting from the sun's heat and polar cold, for in that case the highest average barometer would not be in the calm zones of Cancer and Capricorn, but at the poles, while the lowest barometer would not be in the Arctic circles but in the circles of Cancer and Capricorn.

9.—The winds are not due to thermal convection resulting from the sun's heat and polar cold, for in that case the surface winds of the Earth would not blow from the calm zones of Cancer and Capricorn, but move into these zones. They would not blow towards the line between these circles, and towards the poles beyond these circles but in the reverse directions, nor would the east to west rush of the trade winds cease at the equator, if we regard the sun as acting on the line, though in reality his most powerful inflence with regard to raising the temperature of the atmosphere, under himself, and promoting convection, is when he is most stationary in latitude, at the solstices, over the circles of Cancer and Capricorn.

10.—The winds are not due to thermal convection resulting from the sun's heat and Polar cold, for in that case they would not issue steadily in a dual character from the calm zones of Cancer and Capricorn, but move into a single circle of latitude passing under the sun, there would not be a duality resembling that of the tides of the ocean.

11.—The winds are not due to barometrical pressure of unchanging constancy in the calm zones of Cancer and Capricorn, for in that case they would be constant and steady, without their observed variableness.

12.—The winds are not due to a body shifting its longitude and declination slowly as the sun, but also to a body which shifts its position rapidly, modifying the solar effects, both aiding and entering into conflict with the latter, and this body can only be the Moon, and taken with known shifting of the calm zones, winds, and other effects with the sun, annual changes, we must conclude that the atmospheric circulation and winds, are the product of Moon and Sun combined.

13.—Either of the arguments 4 to 10 are fatal to the theory which regards the winds as arising from thermal convection by the thermal influence of the sun's heat, and polar cold, and collectively they are overwhelmingly against it, and whether the winds are the product of the sun and moon, or of both combined, thermal influences are altogether inadequate to explain the winds, either

barometrically or dynamically considered, and act in directions altogether contrary to the general barometrical circulation and effects.

14.—If we admit that the moon has a large share in making the winds, which is the universal opinion of sailors, gardeners, shepherds, farmers, and every class having an immediate and special interest in the weather, and which has been a widely diffused opinion in all ages, and can be found in the most ancient classical writings, then we cannot assign this share to thermal influence.

15.—Taking the ascertained influence of the sun in producing the winds and modifying their flow, and since we find that the winds are not due to thermal influences, what other force can the sun exert to make the winds, other than thermal radiation.

16.—In so far as the Earth exerts a force to make the winds, in connection with differences of barometric pressures, we must assign the winds to gravitation acting on the mobile atmosphere.

17.—Since gravitation makes the air movements or winds arising from differences of barometric pressure, may not gravitation be the force which makes the air movement which gives rise to the differences of barometric pressure.

18.—That is to say, the same force which deflects the Earth in her orbit, may not this be the force which deflects the air, producing air movements giving rise to differences of barometric pressure and the winds.

19.—We think that arguments 17 and 18 express the actual state of matters, in which case we must assign to the Moon the largest share in the production of the winds, consistent with argument 11, and conclude that the atmospheric circulation is due to solar and lunar gravitation combined deflecting the Earth and air.

20.—Assigning the forces which produce the atmospheric circulation of the Earth to gravitation of the Sun, Moon, and Earth, we have in respect to the Sun and Moon (a) *tidal compress*, and (b) *orbital deflection* of the matter of the Earth and atmosphere as the only possible sources of the circulation. Call these sources *tidal compress* and *orbital force*.

21.—Tidal compress, that resultant of gravitation acting rectangular to the radius vector of the Earth with respect to the Sun and Moon, is not sufficient to account for the difference of air pressure between the calm zones of the tropics, the regions of high barometer and sources of the winds, and the pressure of the poles, the regions

of low barometer towards which the winds blow from the tropics, for we cannot suppose the compress acting alone, to exert a static force of barometric pressure greater than itself. See argument 5.

22.—Hence we are compelled to assign the atmospheric circulation not simply to tidal compress, but to *orbital force* as the predominant force.

23.—Orbital force is expressed in Kepler's 1st and 3rd laws, which assert that the radius vector, or the line drawn from a planet to the primary, describes equal areas in equal times, and that the squares of the times of the planetary revolutions are to each other as the cubes of their mean distances, and when we apply these laws to the particles of the atmosphere considered acting as independent planets, about the Sun and Moon, modified by the Earth's gravitation, then we discover that the atmosphere is deflected by a force capable of accounting for its circulation in every relation of observed effects, whether we regard the distribution of barometric pressure or the directions and velocity of the winds.

24.—If we describe a great circle of the Earth in the plane of its movement about the Sun and Moon, the plane of this circle will be inclined to that of the terrestrial equator, and a diameter of this great circle, will emerge from the Earth in the calm belts of Cancer and Capricorn. The combined Moon and Sun may be regarded as revolving round this circle in a direction from west to east, and the crests of the tidal compress revolving with them in this circle, which may be called the TIDAL CIRCLE, the Moon outrunning the Sun, and the tidal crests moving with the Moon, in opposite hemispheres of the Earth.

25.—The crests of the tidal compress in argument 24, are the ends of a prolate spheriod into which the atmosphere is compressed by the tidal compress of the Sun and Moon, Of the two ends or crests in opposite hemispheres of the Earth, the greatest extension towards space is in the hemisphere illuminated by the Moon, or we may say in the lunar day hemisphere. This follows the application of the law that *the force of tidal compress varies inversely as the cube of the distance from the primary*. This also holds for the orbital force as it affects the tidal crests of the atmosphere.

26.—The tidal crests of the atmosphere are revolving round the Earth's axis from west to east in the Tidal Circle, the great circle of argument 24, completing one revolution in a lunar month, and the calm zones of the

tropics of Cancer and Capricorn may be regarded as the solstices of the tidal crests. When the one crest is in the solstice of Cancer, the other crest is in that of Capricorn, and vice versa, hence the dual character of the barometric zones or circles, giving rise to the atmospheric circulation and winds, while the transition of the tidal crests from solstice to solstice in a lunar month, accounts for the ever shifting, ever changing, character of the winds.

27.—The air of the tidal crests is deflected by the orbital force of arguments 20—23, so that in respect to the motion of the Earth in space, and in the plane of the Tidal Circle, the particles outrun the Earth on the side directed to the primary or point of attraction, and are left behind on the off-side of the Earth removed from the primary or centre of attraction, outrunning the Earth on the one side and becoming left behind on the other, in the plane of the Earth's motion through space, the plane of the circle of the ends of the prolate spheriod of the tidal compress, the plane of the Tidal Circle. This motion of the atmosphere is against the Earth's rotation in both hemispheres in respect to motion of the air over the surface of the Earth. Thus the air of the tidal compress in respect to the rotation of the Earth, is carried round over the surface of the Earth to positions west of the radius vector of its motion in space, and that is so whether we regard the Sun or Moon as the primary, or combine their attractions in a single point, and consider the radius vector of the tidal crests.

28.—We have called the circle of argument 24 the Tidal Circle, because the tidal crests move in this circle, whether we regard the atmosphere or ocean, though the tidal crests of the atmosphere and ocean are in quadrature to each other.

29.—The Tidal Circle posesses an accumulation of air in excess of the rest of the atmosphere.

30.—The Earth in its rotation is cutting the Tidal Circle, and cutting the accumulation of air in the Tidal Circle in respect to all regions in the equatorial zone lying within the calm belts of Cancer and Capricorn or solstices of the tidal crests, in respect that the tidal crests only make the circuit of the Earth in a lunar month, while the Earth completes a rotation in 24 hours, thus relative to the rotating Earth, the air of the Tidal Circle is moving from east to west.

31.—In cutting the Tidal Circle, the equatorial and tropical regions of the Earth, passing under the accumulated air of this circle, share the excess of the barome-

BENTHALL, BROSELEY, SHROPSHIRE, ENGLAND.

Showing the Pioneer Iron Bridge of the World, built over the river Severn, in 1779, by the Coalbrookdale Iron Comp
The white cross on the abutments marks the site of the cottage where JOHN JONES,* the Author of this Treatise
Kinetic Universe," was born on February 5th, 1851.

* Author also of " The Coral Theory of the Lunar Structures," " New Selenography," " The Sun a Dynamo," &c., &c.

trical pressure of the Tidal Circle, and carry the accumulated air round the Earth, along the circles of latitude of those regions which cut the Tidal Circle.

32.—Thus the barometrical excess of pressure of the Tidal Circle is distributed over the circles of latitude within the calm zones of Cancer and Capricorn, in proportion as these circles of latitude underly the Tidal Circle.

33.—It follows from arguments 30, 31, and 32, that since the circles of latitude occupied by the calm belts of Cancer and Capricorn underly the Tidal Circle to the greatest extent of all terrestrial circles, that these circles receive the greatest amount of air accumulated by the *tidal compress* and *orbital force* of arguments 20—23, hence when averages of air pressure are taken over all the Earth, the highest barometer is in the calm belts of Cancer and Capricorn, gradually diminishing as we move linewards towards the equator, where the circles of latitude are both larger and underly the Tidal Circle to a less extent, and rapidly diminishing as we recede from the calm belts of Cancer and Capricorn towards the poles, and in those regions of the Earth which do not cut the Tidal Circle, and of polar tidal trough, from which the air is being continuously withdrawn, to feed the continuous action of the *tidal compress* and orbital deflection of arguments 19—23. Hence when averages are taken the calm belts of Cancer and Capricorn contain the barometrical pressure giving rise to the trade winds within the tropics, and the pole-going winds beyond the tropics, but the real source of the atmospheric circulation is the Tidal Circle, the path of the tidal crests, the path of the prolate spheroid into which the tidal and orbital forces compress and deflect the particles of the atmosphere, of which circle the greatest proportion in respect to latitude lies in the calm zones of Cancer and Capricorn, where the tangent to the circles of latitude and Tidal Circle are in the same line or parallel.

34.—The tidal compress is directed into the Tidal Circle rectangular to the latter, the orbital force deflection of the air is directed round the Earth from east to west, in the plane of the Tidal Circle, and most forcibly in the regions about the radius vector of the Earth with respect to the Moon and Sun, or her motion in space; and it follows that the outflow of air from the Tidal Circle, as wind, is directed from the Tidal Circle at right angles to itself, flowing most forcibly from the base of the atmosphere and decreasingly with elevation above the surface

of the Earth. From the calm belts of Cancer and Capri-
corn, the average outflow is directed meridionally line-
wards and polewards, while on the equator the average
outflow is directed polewards into both the north and
south hemispheres of the Earth. To supply the outflow
from the Tidal Circle there are descending currents,
hence in respect to the terrestrial equator, we have de-
scending currents, and currents directed meridionally
towards the poles of the Earth. These currents give a
calm belt on the equator, that of the doldrums, by reason
of the air particles descending from higher and greater
circles to smaller circles of lower level, thus acquiring a
west to east motion or impetus which balances or over-
comes the east to west motion of the trade winds as these
approach the Equator.

35.—In the calm belts of Cancer and Capricorn, the
average flow from the Tidal Circle is meridional, directed
linewards and polewards, fed by descending currents,—as
are all the outgoing winds of the Tidal Circle, round
its whole circuit,—hence in the calm belts of Cancer and
Capricorn the motion of the air is either from west to
east or dead calm, as with the equatorial calm belt, and
arising similarly.

36.—The atmosphere as a whole is retarded in respect
to the Earth's rotation by the orbital force of arguments
19—23, and therefore as a whole moves from east to west
over the Earth, in the direction of the positive electric cur-
rents or Amperean resultant of the terrestrial magnetism,
and the direction of the travel of the Earth's magnetic
pole in the secular inequality, which magnetic effects and
travel of the magnetic pole may be related to this travel
of the atmosphere.

37.—The position of the greatest barometrical pressure
of the atmosphere, in the Tidal Circle, are the positions
of low tide of the ocean.

38.—The low tide of the ocean, the greatest depressions
of the troughs or basins of the oceanic tides, are pro-
duced by the excess of barometrical pressure of the air
overlying the ocean troughs, and the outgoing winds
passing from these regions of high pressure, the pressure
and winds pressing and blowing out the water into the
regions of lower pressure of the air, the regions of high
tide of the ocean. Lowest level of the ocean lies under the
Tidal Circle, and highest level of the ocean at quadrature
to the Tidal Circle, and as the Earth rotates inside the Ti-
dal Circle of the atmosphere, and in respect to terrestrial
longitude, the Tidal Circle is cut twice in each

synodic rotation, with respect to the Moon, and so in opposite hemispheres of the Earth at points 12 lunar hours apart, there occur two flows and two ebbs of the ocean in a lunar day. But as there are two barometrical maximums, that of the lunar day and lunar night, upon opposite sides of the terrestrial equator in each hemisphere, and these constantly shifting their positions in the Tidal Circle with the motion of the Moon in declination, and the side of the Earth next the Moon possessing the greater barometrical maximum, there arise inequalities in the successive tides.

39.—At times having regard to the positions of the Sun and Moon and their action in the Tidal Circle, air is pouring from the Northern hemisphere into the Southern, at other times from the Southern into the Northern.

40.—Thus the oceanic tides are caused by the forces of argument 20, *tidal compress* and *orbital force* acting on the mobile air of the Earth, the movements of the oceanic tides being produced by and being secondary to the movements of the atmosphere, and in reverse order, piling of the atmosphere in the Tidal Circle being accompanied by withdrawal of ocean waters, and vice versa.

41.—The oceanic currents are produced by the barometric and wind movements of the atmosphere, and are secondary to the movements of the atmosphere, the atmosphere acting directly or by means of the tides.

42.—The continental projections and mountain chains of the Earth compress the air on their eastern sides, as they impinge against and collide with the west going atmosphere the latter retarded by the orbital force of argument 20.

43.—Hence the continents may be said to have a windward and a leeward side, the eastern being the windward side, and the western the leeward side.

44.—The compress of argument 42 determines an excess of barometric pressure, and an outflow of air and wind going polewards over the surface of the Earth, on the eastern or windward sides of the continents, and deficiency of barometric pressure and a wind going linewards i.e. towards the equator on the western or leeward sides.

45.—The winds of argument 44 determine those which passing up the eastern shores and coast of North America, stretch across the Atlantic over the Gulf Stream, aiding to produce the latter, and then pass down the western shores and coast of Europe and back along the southern rim of the Sargossa Sea, determining a swirl of water round the North Atlantic basin round this sea, which air

movement may be denominated the *Sarseraw*, and which passing over the region of Britain, brings gales and storms to our coasts, as well as climatical ameliorations.

46.—Round the rim of the Atlantic basin, coursing on the Sarseraw; storm depressions created in the tropics; round the centres of which the wind is moving against the clock hands, come to Britain at intervals related to those of the tides, twenty-four lunar hours being an important interval as regards pressure and wind, as also the half of this period, the tidal interval. The solar day is also an important interval. There are day and night-tide effects developed on the Sarseraw, as its current cuts the tidal circle, day-produced storm centres with humidity, night-produced storm centres with dryness, with dry and humid anti-cyclonic centres.

47.—In other oceanic basins and parts of the world, similar currents to the Sarseraw are developed by the continental projections colliding with the tidally retarded air, retarded by the orbital force of arguments 19—23, the atmosphere moving over the Earth bodily from east to west in consequence of those forces, though it doubles back near the poles, the recoil of the equatorial impact.

48.—As already indicated, the counter oceanic current of the equatorial zone of the ocean, is due to descending currents of air acquiring a motion from west to east in excess of the Earth's rotation by their descent, but it may be aided by the compress under consideration, which compress is most powerful in the equatorial regions where the tangential velocity of the Earth's surface is greatest. In this case the counter current of the ocean is really a counter current, but due to the motion of the atmosphere.

49.—Apart from the currents of the ocean due to the circulation under the *tidal compress* and *orbital force* of arguments 19—23, all the great currents of the ocean will be found to underly and move with currents of the atmosphere produced by the compress on the windward or eastern sides of the continents as they meet the tidally retarded atmosphere.

50.—Conflict and change every moment is the law of the atmosphere, a condition of things altogether different to what would prevail were the circulation of the atmosphere due to thermal influences and thermal convection. Yet the greater winds have their definite circuits, which may be charted out under a due consideration of the tidal forces of arguments 19—23, and their application to the problems of the weather.

51.—The surface winds of the Earth are produced by descending currents of air acting in those regions where, if they were due to thermal influences of the sun the currents would be ascending currents, and it is physically impossible that these descending currents can be due to thermal influence.

52.—Geographical contour or any distribution of land sea and air, cannot explain the reversal of what thermal considerations would lead us to expect and the conditions of the atmospheric circulation, static, barometric, and dynamic, are exactly the reverse of what any thermal theory would require.

53.—Therefore the thermal theory must be completely abandoned, and give place to the only other possible one, viz.. the GRAVITATIONAL or TIDAL Theory.

54.—The heat of the sun maintains the atmosphere of the Earth in a mobile condition, and condition of great extension, but the tidal forces alone produce the barometric differences, oscillations, winds, and circulation of the atmosphere. These forces are (1) gravitation of the Sun, Moon, and Earth, (2) the orbital motions of the Earth and atmosphere under the primary impulses, (3) the Earth's rotation.

55.—The friction and collision of the Earth and atmosphere and the winds develope heat, which is radiated into space. The Earth is losing rotation equivalent to this lost energy. The atmosphere not the ocean is the tidal brake, retarding the Earth's rotation by an amount which comes under observation.

56.—The Atmosphere may be regarded as rushing bodily from east to west, colliding with the continental projections of the Earth, and developing eddies, whirls, compressions, depressions, anticyclones, cyclones, but the fundamental source of its circulation is the Tidal Circle, where the plane of the Earth's movement in space cuts the surface of the Earth, and the fundamental forces of the circulation are the tidal forces as given in arguments 19, 20, 21, 22, 23, and 54.

57.—The Tidal Circle of argument 24 is the plane in which excess of barometric pressure, is initiated withdrawing pressure from polar regions, and giving rise to the barometric maximums of the calm belts of the tropics those of Cancer and Capricorn, from which issue the great movements of the atmosphere. The semi-diurnal barometric oscillation marks the movements of the atmosphere in and about the Tidal Circle, the depression in the barometric oscillation being due to outflow of air

received 'from the Tidal Circle when cutting the same, and then passing into quadrature with the Tidal Circle by the rotation of the Earth, the air flows away by the superior pressure without an equivalent compensation from the tidal forces. If the Sun and Moon were in conjunction and stationary over the Earth, there would be a great circle of barometrical minimum constituting the tidal trough of the atmosphere and cutting the equator of the Earth. The barometric minimum though attained near the poles of the Earth, where tidal trough always prevails, is only approximated near the equator when in quadrature with the aerial tidal crest, the air not having time to flow off before succeeding tides pile it up again Hence we have only a comparatively small semi-diurnal oscillation of the barometer and a constant excess of air pressure in the latitudes cutting the Tidal Circle.

58.—In the two positions of the Tidal Circle where the barometric pressure of the Tidal Circle is a maximum in the semi-diurnal oscillation, in these two positions the ocean waters are lowest, constituting ebb tide, while in two positions at quadrature with the Tidal Circle, where the barometric pressure is a minimum in the semi-diurnal oscillation, the ocean waters are highest constituting low tide. These conclusions apply to mid ocean, and from these positions the tides are transmitted to the shores of the continents under time intervals dependent upon contour of the ocean and shores. The shore tides are all of the nature of a drift and secondary to the great mid ocean movements.

50.—At any given moment the solid Earth is moving through space in a single direction only, the resultant of its primary or cosmical motion, and gravitation to the Sun and Moon, or of all the forces to which it may be subject. At the same moment every particle of the atmosphere is moving in a different direction to the solid Earth, and as many different directions to each other as there are particles. But the particles of the atmosphere have their motions combined more or less; so that they move more or less collectively in different directions, and these movements acted on by terrestrial gravity constitute the atmospheric circulation. They give rise to the tides and currents of the ocean, which tides and currents of the ocean are the barometric expression of the atmospheric movements, regarding the ocean bed as the mercury chamber of the barometer, and the ocean waters as the mercury acted on by the pressure and movements of the atmosphere, the waters moving and rising and fall-

ing in the ocean bed as does the mercury in the chamber and tube of the barometer. When we deal with the tides and their movements, we are dealing with a barometer of the size of the ocean bed, and which records both pressures and movements of the air.

60.—The Tidal Circle of this paper already defined in argument 24, and so frequently referred to in the several arguments, is a great circle of the Earth, or more properly of the atmosphere, stretching between the calm belts of Cancer and Capricorn in a plane inclined to the Earth's axis so as to just touch these belts in the highest latitude touched by the circle. The Earth is rotating on its own axis in the Tidal Circle in a synodic period of one lunar or tidal day. The tides whether we regard the primary atmospheric or secondary oceanic, pass round the Tidal Circle in one lunar or tidal month, the tides of the lunar day and lunar night passing alternately to the highest declination in the Cancer or and Capricorn calm zones. Thus in each lunar month each hemisphere alternately receive a visit of the lunar day and lunar night tides at the highest declination. Lunar day in this clause, is when the Moon is in the same hemisphere as the observer, lunar night when it is in the opposite hemisphere.

61.—For a proper understanding of the weather, it is desirable to refer all barometric observations, and directions and force of wind, not so much to the equator of the Earth as to the Tidal Circle.

62.—The Tidal Circle is the most important factor in weather phenomena, and from it issue all weather effects.

63.—In the movements of the atmosphere every region of the Earth is in a condition subordinate to that of the Tidal Circle.

64.—The conditions of the atmosphere under its varied movements constitute it such, that if we could see the matter composing it, we should find the atmosphere to consist as it were of continents, islands. mountains, valleys, rivers, seas, and oceans, anticyclones being the denser or continental developments in which the air is accumulated in great quantity, mountains the local regions of accumulated air ; and in the valleys between these dense air continents and mountains there are rivers of air rushing to the atmospheric seas and oceans where the barometer is low. All these developments are on the greatest scale at New and Full Moon, consequently at these periods, whether we consider direct or indirect action by the Moon, the rivers of air rush

fastest, and the winds blow strongest, while at the time of eclipses of the Sun and Moon, storms are of unusually great violence.

65.—While the continents, mountains, valleys, rivers, seas, and oceans of the air are ever shifting, shifting like the sands of the sea, all shifting with the tides, yet just as the beds of sand permanently affect districts which can be mapped out; so the general distribution and movements of the atmosphere possess more or less permanent features which can be charted.

66.—There is a permanent feature of the atmosphere already indicated which we have denominated the Sarseraw. The Sarseraw is a great river or current of air hundreds of miles in breadth, moving round the North Atlantic basin, with the clock hands, skirting the Atlantic shores, and sweeping over the land of eastern North America and Western Europe. All round the Atlantic basin along the course of the Sarseraw are a series of elevations and depressions of the barometer, corresponding to high and low tide, to crest and trough, imposed on the Sarseraw air river as it touches or cuts the Tidal Circle in its course, the lower latitude limits of the Sarseraw touching the higher latitude limits of the Tidal Circle, in or near the calm zones of Cancer. On the Sarseraw the tidal movements of the air in the tropics are impressing themselves in an ebb and flow, and writing their movements on the Sarseraw in characters as plainly discernable as those of the pen. In Britain when we look upwards at the sky, we can see the Sarseraw current passing almost at any time, often marked by transverse wave clouds, but this current while steadily flowing in nearly the same direction, is ever changing in character and intensity.

67.—The velocity of movement of the air composing the Sarseraw current is different at different portions of the lunar month, moving fastest when the tides are running highest, and slowest when the tides are running slowest.

68.—There are barometrical elevations and depressions on the Sarseraw of dry character accompanying night ebbs and flows of the Tidal Circle from and to the Sarseraw, and barometrical elevation and depressions of humid character accompanying day ebbs and flows, these alternating conditions of dryness and humidity, and high and low barometer, round the course of the Sarseraw, being imposed in or near the tropics.

69.—If a very deep depression pass over Britain, mov-

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years of age. Born at Benthall, Broseley, Shropshire, England, February 5th,
1851. Son of William and Maria Palin Jones, of Broseley and Sheriffnales
parentage respectively, and Broseley residence during the boyhood of the Author
of this Treatise.

ing on the Sarseraw, a lunar month afterwards a similar depression may be expected to pass over our meridian, but the latitude may not be the same, and the depression may pass to the North or South of Britain, and its passage be accelerated or retarded a few hours.

70.—If a very wet phase pass over our meridian, moving on the Sarseraw, a lunar month afterwards a similar wet phase may be expected to pass over our meridian. Its passage may be accelerated or retarded a few hours.

71.—It is the motion in latitude, with the varying declinations of the Sun and Moon, of the features of the Sarseraw, its currents, storms, and phases, which has prevented the earlier recognition of the monthly recurrences.

72.—The phases 69 and 70, though these may be shifted in latitude at successive passages, the direction of the shift, whether to the north or south can easily be calculated, from the laws of acceleration or retardation of the Sarseraw flow, and expansions and contractions of the whole circuit on its centre, the condition and position of the whole being dependent upon the positions of the Sun and Moon, and upon whether the tidal forces are increasing or decreasing in successive lunations, and whether the Sun and Moon are proceeding north or proceeding south in their courses.

73.—The Sarseraw is initiated and sustained most forcibly, and receives the greatest push round and impetus of air by the tidal forces, when the tides run highest at New and Full Moon, that is in the greatest degree at spring tides.

74.—At neap tides the Sarseraw receives feebler supplies of air and pushes than at spring tides, and its currents are then moving slowest.

75.—The Sarseraw curretus have an average period dependant upon distance from the centre of the Sargossa Sea, it constituting a great whirlpool of air round the sea, with a sufficient centrifugal force or tangential tendency on the waters, as to render the centre of this sea, actually lower than the rim of the North Atlantic and general ocean level.

76.—Yet the lunar monthly return of phase on the Sarseraw on our meridian in our latitudes, when the changes of declination and intensity are allowed for, is independent of the period of the Sarseraw currents, regarded as a river or whirl of air.

77.—In considerations of local weather affecting Britain, whether we regard seasonal climate, or the visits of

storms, a chart of the Sarseraw; and a knowledge of the distribution of its barometric pressures and currents is the great desideratum for successful weather predictions.

78.—But from the position of the Sun and Moon, and that of the Tidal Circle, and the condition of the latter, the weather of the world may be largely calculated and predicted, and meteorological science be made to evolve law and order for what at present appears to be chaos.

79.—It is not for the writer to attempt to exhaust the subject, an attempt which would be futile for any single individual, but only to indicate the great principles of the weather, viz. that these are tidal and due to the primary impulse of the Earth through space, acted on by gravitation to the Sun and Moon, moving the Earth and mobile atmosphere in different directions, so that if we regard the solid Earth as moving in the proper orbit, then the perturbations of the mobile atmosphere by gravitation to the Sun and Moon is the source of the atmospheric movements, and circulation by these perturbations is the cause of the oceanic tides.

80.—While on the Sarseraw, given conditions or phases return in our latitudes and in its course generally in a lunar month, there are phases which more locally recur in a lunar day.

81.—Thus if the barometer rise suddenly by the passage of a high tide of the air barometrical elevation on the Sarseraw, then 24 lunar hours afterwards the barometer may give another jump.

82.—Again, if the barometer fall suddenly by the passage of a low tide of the air barometrical depression on the Sarseraw, then 24 lunar hours afterwards it may give another fall.

83.—Thus by 81 & 82 the barometer will attain its highest and lowest points in our regions by successive jumps, its usual method of rising and falling.

84.—But storm elevations and depressions may be regarded as due to currents and eddies of the air under great tidal movements of the atmosphere, due to conflicts of air, and air and land, rather than to the great atmospheric tide directly. The latter is expressed by the semi-diurnal barometrical oscillation, which does not oscillate the barometer in the general movement so much as currents and eddies do locally. Two currents meeting or passing to the same region, pile up the pressure as with the tidal compress and orbital force, but two currents receding from each other or from the same point, make a barometric depression, while the wind

rushing past or over a mass of dense stationary accumulated air, makes a barometrical depression in rear of the latter. Yet the semi-diurnal barometrical interval whether we regard the action of the Sun or Moon singly, or combined in the greater tidal barometrical oscillation of the semi tidal day, will make itself felt in the return of weather phases from day to day, and tide to tide.

85.—Weather prediction would have been a simple matter if the atmospheric circulation had been due to thermal convection, though in that case the circulation would have reached vanishing point, and the Earth had been a rainless, sterile, uninhabited desert.

86.—Hence although the weather phenomena is complicated, it is a consolation that apart from these complications; we should not have been here to study it and feel its benign influences, and its change of position with that of the plane of the lunar orbit.

87.—Blame the changes in the Tidal Circle, if the weather appears to be erratic.

88.—With the Sun and Moon both engaged now aiding each other, now in conflict, their combined effects producing the atmospheric circulation, it must necessarily be very much more complicated than if only one body was concerned in its production.

89.—The Sun's thermal influence must be regarded as producing some convection, but the tidal forces outweigh and suppress its manifestation, which has already been shown in the previous arguments.

90.—If we recognise the thermal influence, it can only be as a disturbing force producing further complication.

91.—We must be very careful even in assigning land and sea breezes of a local character to thermal influences, or why the proverbial calm of the evening when we have heat and cold most contrasted, and in close juxtaposition.

92.—If we turn to Horace's Odes, (L. 1 ,25) we read ": The *Thracian* North wind raging more about the change of the Moon, *than at other times*. So Livy, iv. 20, "Interluniorum dies tempestatibus plenos navigantibus quam maxime metuendos, non solum peritiae ratio, sed etiam vulgi usus intelligit ;" i.e. " Reason and experience has made appear, even to the observation of the vulgar, that at the change of the Moon, when the Earth is placed betwixt the Sun and her, that period of time is rendered very tempestuous, and greatly to be feared by seamen, and others who sail upon the seas." Certain new moons are certainly the most dangerous storm positions that can occur, even more dangerous than full moons.

93.—The observations and experience of seamen, shepherds, gardeners, and in the words of Livy, even of the vulgar with regard to weather, surpasses in the results, those obtained by the closeted physicists, astronomers, meteorologists, and others, who have asserted that the lunar influence on the weather is only moonshine, and regarded almost as lunatics those who have asserted that the Moon does really influence the weather.

94.—Those who ought to have known better, have been asserting that the Moon possessed no force which could appreciably influence the weather.

95.—If the Moon can shift the entire solid globe over many miles of space, over the course of the Earth's orbit about the common centre of gravity, swaying the Earth as a mother does a baby in its arms; then just as the robes of the baby are swayed in the process, so the air robing the Earth as loosely as the baby's clothes, is swayed by the Moon, in both cases with subsidiary eddies and currents of air.

96.—The Sun and Moon shaking out the atmospheric robes of the Earth, sway vast volumes of air, now to this hand and now to that, as the Earth undulates up and down in the gravitative arms of the Sun and Moon, but as the baby's robes flow up and down regularly to the rhythmic tossing by the mother, so the movements of the atmosphere on the large scale under the tidal forces of the Sun and Moon are equally regular, and in equally definite directions which can be calculated and predicted with mathematical precision.

97.—It is an easy matter to calculate what is the path of the solid Earth, and initially what is the position and condition of the Tidal Circle and path of the air, as the Earth is moved by gravitation of the Sun and Moon and the air is swayed by the tidal forces.

98.—Nor is it difficult to follow the air in its courses with respect to the main channels.

99.—The lowest barometer near the poles of the Earth and the highest in the tropics of Cancer and Capricorn, the difference of pressure of these minima and maxima of terrestrial atmospheric pressure, these differences of pressure are not merely effects, but are the actual causes of the atmospheric circulation in respect to the winds blowing over the surface of the Earth, and just as in a storm, the air moves from the region of high to the region of low barometer, so whatever be its circuits and the channels that its motions may favour, the air is continually moving from the tropics towards the poles as winds;

in a manner in which the poles may be regarded as great
storm centres, and similarly from the calm zones of Can-
cer and Capricorn towards the lesser barometric mini-
mum on the equator.

100.—And the difference of barometric pressure be-
tween the calm zones of the tropics of Cancer
and Capricorn and the poles, is a measure of the
tidal forces exerted on the air, (not thermal forces, since
the latter act in exactly opposite directions, and if ex-
istent have to be overcome before the tidal effects are a
possible quantity at all, thus further exalting the ex-
pression of the tidal forces), but not the full measure,
formation of the polar depression and filling up again
by the air are going on simultaneously. Hence the static
expression of the tidal forces of arguments 19—24, and
54, as between the calm zones of Cancer and Capricorn
and the poles considerably exceed ·7 inch of barometric
pressure difference between these regions, and give an
atmospheric circulation proportionate to this, between
these regions. To express the whole tidal force we have
also to consider the circulation directed towards the
equator from the tropical calm zones. The whole force
of the atmospheric circulation may be said to be devel-
oped in the Tidal Circle. And allowing for a little dif-
ference of inclination due to the Sun, the position of the
Tidal Circle round the Earth, is ever the plane of the
lunar orbit. And the tables which govern the position
of the Moon, and the lunar cycles, are all applicable to
the Tidal Circle subject to corrections for aberation by
the Sun. And for first rough approximations we may
consider the Tidal Circle as in the plane of the path of
the Moon round the Earth, although to be correct the
two circles are inclined a little to each other, but by an
amount never exceeding 5°.

101.—In so far as the heat of the Sun and thermal
convection draws air into the tropics, the tidal forces of
the Tidal Circle use this air only to pile up the pressure
in the Tidal Circle, and thus give results exactly op-
posite to what thermal action acting alone would give.

102.—The actual expression of the tidal forces is the
dynamic energy of the winds of the Earth, the whole of
which is balanced against the retarding forces, friction
with the Earth's surface, and impact against its rotation.
Were it not for impact and friction, the atmosphere
would become nearly stationary relative to the rotating
Earth, only rotating on the axis once in a lunar month, and
become a wind on the Earth moving against the rotation

from east to west with a velocity attaining nearly 1000 miles per hour on the equator.

103.—The tidal forces 19—24, and 54, are engaged retarding the atmosphere, the rotation of the Earth is engaged accelerating it, and in a semi-lunar month the Sun and Moon alternately superpose their effects and act in quadrature, and though the tides vary in height in consequence, yet the combined retardation is always the sum of their actions, their united actions giving rise to an atmospheric belt of high pressure, the Tidal Circle, along which the pressure varies and is variable from point to point with reference to the positions of the Sun and Moon, but which belt of high pressure is always a weight or mass of air moving against the Earth's rotation, and causing the tides, as the meridians of the Earth transit the circle or come into quadrature with the same, and as the air rushes directly along the Tidal Circle. Properly speaking there are two Tidal Circles, one of the Moon the other of the Sun, situated in the plane of the orbits of these bodies, the Ecliptic plane and that of the lunar orbit respectively, and these two Tidal Circles sometimes superpose their effects, and at other times act in quadrature, according as the Moon and Sun are in conjunction or at quadrature, and according to the position of the Sun in its annual course. There being two Tidal Circles, that of the Moon and that of the Sun, this is another source of atmospheric complication, conflict, and commotion.

104.—When the Sun is going south and most rapidly, from July to October, a proportion of his tidal piling of the air by the forces 19—24, 54, is being withdrawn from the calm zone of Cancer and the tropics of the Northern hemisphere, then the pressure of these regions finding itself proportionately unsupported, bursts along the course of the Sarseraw, into depressions formed along its course accompanying the movement, and the wind attains unusual violence, giving rise to the West India hurricanes. Similarly when the Sun is coming North from Jan. to April, air is being withdrawn from the calm zone of Capricorn and the tropics of the Southern hemisphere, then the pressure of these regions bursts along the course of an Indian Ocean southern hemisphere Sarseraw, (which we may call the Indian Sarseraw, and which swirls round the Indian Ocean in a manner similar to the Atlantic Sarseraw, and overlies and is charted out by the south equatorial current and other currents of the Indian Ocean,) and produces the hurricanes of the Indian

Ocean of the type of the Rodriguez hurricane of April, 1843. The hurricanes of the North Atlantic, Indian Ocean, and 'the Typhoon storms of Japan; all move on air swirls or currents of permanent type, Sarseraws, connected with the banking of the air on the westward or windward side of the continents of North America, Asia, and Africa respectively, as the rotating world meets the tidally retarded atmosphere, retarded by the forces of arguments 19—24, and 54.

105.—The development of hurricanes in the Northern hemisphere, will be most intense when the Sun and Moon are both in conjunction, and both travelling south from July to October, while in the southern hemisphere they will have their maximum development and force when the Sun and Moon are both travelling north together from January to April. At these times pressure is falling fastest in the tropics of Cancer and Capricorn respectively.

106.—When we examine the Sun, we find that the solar circulation, almost precisely resembles that of our atmosphere. As with the latter the circulation in the Sun is not thermal but gravitational and tidal, viz., descending currents in the equator of the solar atmosphere, with two zones of maximum barometric pressure in the higher latitudes of the Sun. The sun spots move in what may be denominated the trade winds of the Sun, that is to say, in a strata of the solar atmosphere which is moving against the Sun's rotation and towards the solar equator, just as the trade wind strata of the Earth moves against the Earth's rotation and towards the terrestrial equator. On the solar equator there is a calm resembling that of the Doldrums of the Earth, and due similarly to descending currents, and to the tidal atmospheric currents of the Sun passing polewards from the solar equator just as they do on the terrestrial equator. And the solar circulation is such as to indicate that there is a large intra mercurial planet whose orbit is very much inclined to that of the solar equator, with a tidal circle whose highest solar declination touches the higher limits of the spot zones, say approximately inclined 45° to the solar equator. This planet, (or planets, for there may be two) has a tidal circle lying across the solar equator in the plane of which the tidal compress of this planet, and the orbital force of the Sun about this planet, piles up the solar atmosphere, producing a barometric pressure at the base of the solar atmosphere which gives rise to the observed circulation of the photo-

sphere. The solar tidal circle is subjected to perturbations by the gravitation of the Sun to Jupiter, and other planets in conjunction with Jupiter and the intra mercurial planet, hence the sun spots developed in the solar tidal circle, are continually shifting their distribution in respect to latitude in the Sun. The sun spots are developed in what may be denominated the hurricane regions of the Sun, but do not necessarily mark hurricanes in the Sun but rather the cloudless rainless regions of the Sun, a state of the solar atmosphere similar to that which prevails over the rainless districts of the Earth, and probably arising from similar causes and marking continental development in the Sun. The cloudless, rainless condition imposed on portions of the solar atmosphere constitute the sun spot openings in the photospherial cloud envelope, and though the source may be continental, moving with the solid globe of the Sun in the period of rotation, the spots themselves move in the tidal drift or circulation, from east to west in the Sun; and against the rotation unless on the equator of the Sun. The Sun at the base of the solar atmosphere is a solid globe; and the movements of the sun spots on the solar equator, their period gives the nearest approximation to that of the rotation of this globe, since the solar equator is the circle of calms or doldrums in the Sun. We must proceed polewards in the Sun beyond the latitude 35° before we reach the Cancer and Capricorn calm zones of the Sun, but doubtless these exist there. To determine these is to determine the inclination of the Tidal Circle in the Sun, and approximately that of the orbit of the intra mercurial planet. The sun spots have a proper motion in the period of revolution of the intra mercurial planet which may be made of use to indicate the position of the latter, the plane of its orbit, and its period, and thus lead to its detection and the ascertaining of all the elements of its orbit. As the intra mercurial planet revolves round the Sun, the condition of the Tidal Circle of the Sun varies with respect to atmospheric piling and pressure, the trade wind zones of the Sun move alternately north and south in the Sun; with the motions of the intra mercurial planet, just as they do on the Earth, with the Sun's annual movements across the terrestrial equator, and just as they do doubtless with respect to the Moon's monthly movements across the terrestrial equator. The movements of our atmosphere in respect to the shifting of the winds, rains. and currents of the ocean, and following the march of the Sun in its annual

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course, are in great part typical of those which follow the Moon in its monthly course, and just as in the year we have times when March winds blow strongly, and other times when November fogs burst upon us, so in the lunar month we have wind positions and fog positions, and similarly as we have rainy seasons of the year so we have rainy portions of the lunar month, and all these changes whether solar or lunar are produced by the forces 19—24; 54, the tidal forces, acting on the atmosphere, ever pressing and deflecting it in directions which can easily be calculated, once it is recognised that the atmospheric circulation is tidal and not thermal.

107.—We have mentioned the solar circulation, because, when we correlate all kindred phenomena, we are better able to generalize, than when we study the Earth and its atmosphere only, and are enabled to put the views announced to every possible test. And when we find calm on the equator in both the Sun and the Earth, consistent with descending not ascending currents, and when we find that the Tidal Circle gives off currents only polewards on the equator which necessarily demands descending currents and calm on the equator if the descent is sufficiently rapid, and yet find currents going out from the tropics towards the equator and apparently none returning into the tropics below to supply the output, we are bound to conclude that the indraught into the tropics is an indraught by tidal compress to supply the output resulting from the excess of barometrical pressure in the tidal circle, imposed by the orbital deflection of the particles of the atmosphere as these endeavour to follow Kepler's three laws in their course round the primary. And if we graphically describe the orbit of the Earth about the Sun or Moon, and measure off the area described by the Earth's centre in a small elementary portion of time, and then if we do the same for a particle of air on the radius vector, the difference of arc or its sine in that time, will give the force of the acceleration deflecting the particle round the Earth from east to west over the surface. This deflection of air demands a supply to replace the air removed, and the deflection is in the place of the tidal circle, and the supply is by the tidal compress rectangular to this plane, the opposite direction to the output of air from the Tidal Circle, the supply being an indraught of low tension, affecting almost the entire depth of the atmosphere, and the output an output of high tension due to the compress or weight of the air on the base of the tidal circle, hence the particles of air move slowly into the tidal circle at every level except the base,

from which they rush out to produce the atmospheric circulation. And if we draw the tidal circle cutting the equator, and draw lines at right angles to it representing the force and velocity of the air output, we shall find that at the equator of the Earth these lines are directed into the north and south hemispheres respectively upon op· posite sides, while as we recede from the equator, the opposite going lines drop more and more into the hemisphere into which we are passing until when we reach the latitudes of Cancer and Capricorn the forces and currents of air issuing from the base of the Tidal Circle are directed toward the equator between the Cancer and Capricorn calm zones, and towards the poles beyond these zones.

108.—The rotation of the Earth by centrifugal force or tangential tendency gathers the air in excess on the equator. The tidal compress and orbital deflection forces the excess of air from the equator into the Tidal Circle, diminishing pressure at the equator and piling it up in the calm zones of Cancer and Capricorn. To supply the deficiency of pressure on the equator further air is drawn from the geographical poles by the centrifugal force, diminishing pressure on the poles. Thus from these causes alone arises a barometrical depression of about equal amount on the geographical equator and poles. The Tidal poles are further denuded of air by the tidal compress and orbital deflection, drawing air directly from the Tidal Poles, thus arises the two barometrical minimums of the atmosphere, on a circle of latitude intermediate between the poles of rotation and the poles of the Tidal Circle.

109.—Thus we may say the rotation of the Earth by centrifugal force or tangential tendency gathers the air in excess on the equator. The tidal compress and orbital deflection, 19—24, forces the excess of air into the Tidal Circle. These forces draw air directly from the Tidal poles into the Tidal Circle. The orbital force deflects the excess and indraught into regions from which the orbital force and compress is removed, thus giving rise to the barometric pressure of the Tidal Circle and the two barometrical maximums of the calm zones, that of Cancer and Capricorn respectively, from which issue the winds and currents of the atmosphere, flowing to the corresponding barometric minimums of the poles.

110.—Thus the rotation of the Earth supplies air into the equatorial regions of the Earth, the tidal compress and orbital force, 19—24, supply air into the Tidal Circle,

and the orbital deflection by the tidal force, sets up the barometrical pressure which returns air from the Tidal Circle to the Tidal Poles and back to itself in the regions of quadrature or tidal indraught, and so gives rise to the winds and currents of the atmospheric circulation.

111.—The two barometrical minimums of the Earth, in the north and south hemispheres respectively, are not as already indicated, on the geographical poles, but on the tidal poles on the circles of latitude which rotate through the Tidal Poles, and which circles of latitude may be denominated the Tidal Troughs of the atmosphere.

112.—The tidal poles are 90° removed from the Tidal Circle in the opposite tidal hemispheres, while the tidal troughs of the air, the troughs of barometrical minimum, are the circles of latitude rotating through the tidal poles, and almost coincident with the Arctic Circles. On the geographical poles themselves, if we could get there, we should find the barometrical pressure to be greater than on the arctic circles.

113.—Just as the tropics and calm zones of Cancer and Capricorn take excess of air by rotating under the tidal crests and Tidal Circle, 31—33, so the tidal trough circles take a minimum of barometer by rotating under the Tidal Poles.

114,—If the Sun were the only body producing tides, the circles of barometrical minimum would be the arctic circles. but the lunar orbit being inclined 5₀ to that of the Sun, and the Moon being the dominant partner in producing the atmospheric tides and circulation, the tidal circles are deflected proportionately, by a quantity of course not exceeding 5°, the inclination of the ecliptic to the lunar orbit, thus placing the circles of barometric minimum approximately in the latitude of the pole of the lunar orbit.

115.—But consequent upon the rotation of the Earth sharing in producing the tides as already indicated 108—112, the geographical latitude of the Tidal Pole and trough, and barometrical minimum, exceeds that of the arctic circle, as appears from the following Table of barometric averages deduced from observation. By Tidal Pole and trough we here refer to that of the atmosphere, the barometrical minimum of the Arctic Circle being a trough of that movement of the atmosphere under orbital force which piles the air in the Tidal Circle. The oceanic Tidal Trough is along a meridian great circle of the Earth at quadrature with that of the oceanic tidal crests.

TABLE.

South Latitude.	Average Height of Barometer.	North Latitude.	Average Height of Barometer.
0° 0′	29.974	0°	29.853
13° 0′	30.016	10°	30.002
22° 17′	30.085	20°	30.004
34° 48′	30.023	30°	30.069
42° 53′	29.950	40°	30.006
45° 0′	29.664	45°	30.011
49° 8′	29.469	50°	29.943
51° 33′	29.497	55°	29.960
54° 26′	29.347	60°	29.835
55° 52′	29.360	65°	29.623
60° 0′	29.114	70°	29.722
66° 0′	29.078	75°	29.863
74° 0′	28.928		

The above Table, places the tidal trough of the atmosphere and barometrical minimums in latitude about 69° in the northern hemisphere, and 74° in the southern hemisphere, and show that centrifugal force of the Earth's rotation, tidal compress, and orbital force, have a greater action on the southern hemisphere than on the northern, the land of the northern hemisphere by friction and impact impeding the tidal movement, and preventing its full development in this hemisphere, thus relatively forcing the southern tidal trough and barometrical minimum to higher latitudes than the northern.

117.—The same thing acts to tilt the tidal crest, or calm zones of Cancer to higher latitudes than that of Capricorn, and to throw the tidal equator into the northern hemisphere into the circle of the doldrums.

118.—If the Earth were entirely covered by an ocean of uniform depth, the tidal and barometrical effects would be symetrical in both geographical hemispheres, but there are no deflections of effects but what can be easily calculated.

119.—The tidal atmospheric trough about the arctic circles varies in barometric pressure at different periods of the lunar month, the pressure being lowest at new moon and full moon, and highest at the quadratures, and the range of the oceanic tides may be regarded as a measure of the variation. There is also an annual variation of pressure superposed on the lunar, but for practical purposes this is measured with the lunar, and the range of the ocean tides becomes a measure of both solar and lunar variations of barometric pressure about the tidal trough of the arctic circles. When pressure in the

arctic circles is lowest, it is highest in the Tidal Circle and calm zones of Cancer and Capricorn and vice versa.

120.—Thus when the oceanic tidal range is increasing measured from highest to lowest level of the water, the average barometer is falling in the polar regions and increasing in the equatorial regions of the Earth, and conversely when the oceanic tidal range is decreasing, the average barometer is rising in the polar regions, and falling in the equatorial regions. This semi lunar monthly flow and ebb of the air towards and from the equator, is accompanied by corresponding changes in average temperature, and cold and warmth will alternate with the lunar weeks or quarters.

121.—Thus the tidal range of the ocean waters which can be measured on our own coasts, is a barometer indicating the amount and distribution of average barometric pressure over the calm zones of Cancer and Capricorn, and in the arctic circle of the geographical pole, and roughly a measure of temperature the world over. The directions of the variations can be predicted equally with the tides, the amount can be approximated by calculation equally with the height of the tides, but the exact value can only be determined by observation.

122.—When the oceanic tides are highest, then, when the barometer is highest in the calm zones of Cancer and Capricorn; and lowest in the polar regions of the Earth, then the atmospheric circulation is most energetic, its winds and currents are most strong, and storm centres and depressions are developed of the deepest character, aud coming round on the various Sarseraws, inflict the greatest damage on the various coasts. At new and full moon, especially at the times of solar and lunar eclipses, and when a very high oceanic tide prevails, then let fishermen and sailors closely watch the barometer, for storms at these times attain the greatest vehemence and force, the atmospheric disturbance and contrasts of pressure being greatest at these times, though it must be ever remembered that the greatest storms are manufactured near the tropics, and that there is a time interval before they strike distant coasts, but in their course they vary greatly in depth, and these variations are greatest at new and full moon in every region, and when barometical depressions are running deepest, and elevations are running highest, when the barometer is rocking most, at new and full moon, the weather is universally in its angriest mood, and storms are then the most destructive. The Tay Bridge storm

was preeminently of this class, occurring on the day of a
lunar eclipse, and when the Sun and Moon were both in
high declination, and the Earth near perihelion rushing
almost at its fastest through space, and the air piling up
in the Tidal Circle almost to its greatest maximum, and
falling at the poles almost to its lowest minimum, then
it was that the atmosphere appeared to almost drop ver-
tically into the depression which passed over Britain
and rushed the Bridge over, the barometer fallng to a
very unusually low point immediately before the storm.
Other great storms have accompanied eclipses of both
the Sun and the Moon, so frequently and of such great
violence, as to indicate not merely coincidences, but a
close connection with the tidal effects of these positions
of our luminaries. And if further proof were required,
it is known that earthquakes are more frequent at the
conjunctions of the Sun and Moon than at other times,
and just as we assigned the oceanic tides to the atmos-
pheric movements, so it would appear that earthquakes
result from the great movements of the air giving rise to
the atmospheric circulation and oceanic tides, the tidal
movements of the air, which remove pressure from cer-
tain parts of the Earth's surface and crust, and pile it
up in other parts, and under the great inequalities of
pressure of the atmosphere and the variations, and under
the effort of particles of the solid Earth to obey the
orbital force which deflects the atmosphere and to move
in independent orbits about the Sun and Moon, we are
inclined to believe that even the surface of the solid
Earth heaves and throbs under the tidal forces of 19—
24 and 54, but secondary to the movements of the atmo-
sphere.

123—Demonstrated §§ 1 to 122.

(A) Rotation of the Earth, its motion in space, and gravi-
tation of the Sun, Moon, and Earth, and their motions, act-
ing on the mobile atmosphere, these are the forces which
give rise to the atmospheric circulation and oceanic
tides, and (B) the circulation of the ocean, including the
tides, waves, and currents, is secondary to the atmo-
spheric and caused thereby. And when these principles
are recognised, then, and then only, shall we have a
science of meteorology worthy oi the name, and embrac-
ing all the movements of air, water, and the Earth's
crust, thus completing the connections between meteoro-
logy, seismology, and geology, and rendering these kin-
dred sciences subordinate to that of astronomy.

124.—If the demonstrations (A) and (B) 123 are regarded by the reader as not yet complete, and if the demonstrations against the thermal view of the atmospheric circulation, and in favour of the orbital force gravitational convection view of this treatise are so regarded, then these shall be further demonstrated when dealing with Precession of the Equinoxes and Nutation by aid of diagrams.

125.—Before proceeding to the more important subjects of Precession and Nutation, with the readers' consent, we will have an interlude, giving off a few thoughts of the writer, upon many important subjects, some of which may be somewhat apart from the immediate purpose of this treatine, on the basis that just as there is a correlation of physical forces, so there is a correlation of mental forces, and if the reader attaches any importance to the matter of this treatise, it cannot be altogether uninteresting to know what manner of man the writer may be. And also in this interlude, we will give some of our announcements which have appeared before in other publications. Thus the interlude may be regarded as " a peg to hang a hat upon," and some readers may feel disposed to cut off the head that wears it, but for one enemy we may raise, let us hope that we shall raise a dozen friends, and then all will be well.

126.—In dealing with the question of the Atmospheric Circulation Oceanic Tides, Precession, and Nutation, the writer has found the laws of motion as given in the text books almost inextricably confused, often erroneous, and this even in Newton's Principia.

127.—It is not surprising that this should be so when we find so much ignorance and confusion in almost every department of life and action.

128.—Thus in fiscal matters, statesmen and legislators, supported by a mass of deluded or indifferent followers, make a charge for allowing treasure to come into a country, when, if there must be a fine at all, it would be more rational to inflict a fine upon those who are taking it out. Purchase is barter in which gold is one of the two or more substances exchanged, and it would be as rational to tax a coin going into a country as to tax the other substance of the exchange. To stop the exchange in respect to either equivalent is to stop it in respect to both, and if carried to its utmost limits would stop international trade entirely. Nations who impose prohibitory tariffs rob the world's merchants of their markets, break the Mosaic laws " Thou shalt not covet" what is thy

neighbours, "Thou shalt not steal" what is thy neighbours, trample on the minority of themselves who think justly upon these matters, and produce beggary and poverty all round. With a world of an increasing population to be clothed and fed these tariffs must go.

129.—Again, in politics and the domain of legislation and morals, we find a system which derives its revenue from vice, a system which leads to the imbibing of subtle poisons such as alcohol and tobacco, both of which corrupt the heart, take the fine edge off the nerves, muscles, and brain, impair the blood, and lead to physical degeneracy, prematnre death, and national degradation and decay, a system which requires for its maintenance 40,000 policemen, and inflicts upon the citizens of Britain a still larger army of upwards of 200,000 publicans, the latter an army more detrimental and destructive to national life, than even an army of occupation composed of foreigners could possibly be, a system whose blood money is largely used to pay our soldiers to conduct wars, which whether just or unjust, should not be supported in this way.

130.—Then in religious doctrine there is a system which defers baptism too long, leaving many of God's true children unbaptised to drift into the world, a system making a God as it were of baptism, making it an end instead of a means, and a still larger system, of which, if it can be said it administers baptism at all, so traduces and administers this sacrament as to nullify its use altogether. Surely there is some *via media* which could reconcile the difference of opinion on this matter. " To the law and to the testimony, if they speak not according to this, it is because there is no light in them." Then in religious practice we see the alcoholic cup of devils used on the tables of Christians, and what is more horrid still, used at the Lord's table. And ministers and laymen calm their consciences and expect God's blessing on their labours. Thus we see the most holy and most sacred things in doctrine and practice all confused by the grossest ignorance, and centralization no cure for the evils, but only making them worse,

131.—Millions may define a pope as infallible, but it does not make the doctrine one whit more true than if not held at all. And so with the laws of motion, however many high priests of science, and however many persons who sit in the seats of learning, may declare a view to be true, and however many learned societies may countenance it, and even if supported by Govern-

ment money, it does not make the view one whit more true, if it is contrary to the operations of nature, and the results deducible from observation.

132.—Much that is assigned to the laws of motion, including orbital motion of a globe in space about its companion or primary, is only true in ratio and not in absolute quantity; and much is false in both ratio and quantity, hence the irrational tables of planetary densities, and of the Sun itself, which at present prevail in circles posing as authorities, and are imprinted in the text books.

133.—No system of natural philosophy can be sound which does not assign to the planets of the Solar System and their matter physical characteristics resembling those of the Earth., both in quality and density, and this is a resemblance which must also extend to the Sun and Stars.

134.—The results based on the present tables of the planets must be received with caution, for undoubtedly these tables are false to fact, and any influence they possess in correcting or approximating results of observation and measurement, is very likely to introduce error into the latter.

135.—The absolute quantity of the fall and acceleration of a planet under gravity toward the primary is greater than the quantity assigned by the Newtonian philosophy, as is also the centrifugal tendency in the orbit in the proportion of 11 : 7.

136.—The value of gravitation for the Earth's surface may have been correctly deduced from pendulum observations, but even here no measure of the fall and acceleration produced by gravitation will be satisfactory until it is deduced from the direct unimpeded fall of a body in a vacuum which can easily be done by means of instantaneous photography or by electric contacts, or by both combined. It is perhaps hopeless to expect to obtain such an experiment except by an individual effort on my own part ; for I have found most scientific men who are in a position to aid in this matter, thick-headed and incapable of receiving either the highest intuitions or to understand the simplest proofs, unless backed by some incoherent unintelligible formulæ, which assumes quantities which have no existence, such as regarding an infinitely small quantity as nothing, an infinitely short curved line as straight, and similar absurdities and begging of the question. Manifestly if an infinitely small quantity of matter is nothing, an infinite number of small quantities is nothing, and so the universe of

matter would have no existence. Similarly if an infinitely small portion of a curve is a straight line, an infinite number of such curves placed end to end must be a straight line, and the ellipse and circle could have no existence. Then on deducing the path of a projectile or of a planet parallelograms of motion or force are drawn having straight sides and diagonals, whereas in point of fact at no moment can the velocities be so represented. The proper measure of the movement of a planet is the amount of momentum conferred or removed in a given time, the centripetal force acting on a planet being simultaneously engaged conferring tangential momentum and destroying it, and in such a way that the orbital motion of a planet may be regarded as conferred by gravity not simply by a primary impulse, but such that in every quarter-revolution the force of gravity has both conferred and destroyed a momentum equal to the tangential momentum, so that if $M ═$ the tangential momentum in the orbit. $2\ M ═$ the force of gravity in the time of a quarter revolution, and if $R ═$ the radius then $\frac{11}{7}$. R equals the velocity destroyed and $\frac{11}{7}$ R that conferred in a quarter revolution, and the sum $\frac{22}{7}$ R is the total value in momentum in the time of a quarter revolution, and $\frac{11}{7}$ R is the value of the space or fall towards the primary in the time of a quarter revolution. And this value agrees with the motion of a planet as deduced by the writer from that of a pendulnm compared with that of a planet in its orbit, and by geometrical and mathematical demonstrations which may be given later on in this treatise.

137.—Sir Isaac Newton was a dawning light.

138.—The Principia however is a little nebulous.

139.—We must have a brighter illumination than that of the Principia, and get back more and more to the Keplerian intuitions, and endeavour to bring these into adjustment with observation, and to place them on a strictly scientific and accurate basis.

140.—Cor. 20, Prop. 66, book 1, of the Principia though based on a true movement of the isolated detached Moon is altogether falsely conceived, it begs the question, is not contained in the preamble to the proposition or theorem and is absurd, which shall be demonstrated later on by the writer in this treatise.

141.—With all respect to the memory of Newton, doubtless there are other errors in the Principia, and that this is so is quite manifest by the various absurdities of modern planetary tables, based on the Newtonian philosophy, such as that which assigns to Saturn a density

less than that of water, whereas this planet is evidently a consolidated globe like our Earth, and in a similar stage of development, and therefore likely to resemble the latter in density.

142.—But before giving further considerations regarding these matters, let us embody one of the stepping stones to right conceptions, by reprinting our Nineteenth Century and Victorian Announcements as these appeared in the Dundee Weekly News of Dec. 24th, 1898, and the Dundee Evening Telegraph of Dec. 25, 1899 respectively.

JOHN JONES'S VICTORIAN ANNOUNCEMENTS.
(From the Dundee Evening Telegraph, of Dec. 25, 1899.)

Last Christmas I announced that gravitation was a central force, increasing to the centre of the Earth by the law of inverse squares—i.e., half the distance from the centre, four times the force, one third the distance, nine times the force, and so on. A surface, a thing of length and breadth, but no thickness, can have no force, and gravitation must necessarily reside in the mass, and in this respect we have no reason to suppose that large masses like the Earth will differ from small masses like the molecule. Besides magnetism is the analogy with gravitation, and it is a force increasing to the centre of the magnet. I have now to announce another law—viz., that *for a homogenous sphere of given volume the force of gravity varies as the density squared*—*i.e.*, half the density, one fourth the force, one third the density, one ninth the force, three times the density, nine times the force, and so on. This arises from density being the expression of distance between the particles whose mutual influence varies as the inverse square of their distances. We are now to furnish a table of rational masses and densities for the sun, moon, and planets, which, it may be presumed, are not likely to differ greatly in density from each other and the earth, and in every case must greatly exceed the density of water. We shall place the old tables side by side with the new. An influence of the sun increases the gravitation of the planets in a way dependent on distance, so that those near the sun have their force increased more than those more remote, and thus appear to be more dense than the latter. When the required correction is made for this influence it will be found that the different members of the solar system differ still less in density than heretofore supposed. Table 2 is given without this correction, which may be given on a future occasion,

TABLE 1.—*Irrational.*—Based on the Newtonian Theory of Gravity which regards the Earth's Force of Gravity as Diminishing to Nothing at the Centre.

	Distance from Sun in Miles	Diameter in Miles	Volume Earth's being Unity	Mass Earth's being Unity	Density Earth's being Unity	Density Water being Unity
Sun,	0	853,737	1250000.000	315000·000	·252	1·444
Moon,	91,430,000	2,160	·020	·011	·544	3·207
Mercury,	35,393,000	3,010	·055	066	1·210	6·860
Venus,	66,131,000	7,707	·919	·778	·850	4·810
Earth,	91,430,000	7,927	1·000	1·000	1·000	5 650
Mars,	139,312,000	4,247	·154	·112	·737	4·170
Jupiter,	475,693,000	86,520	1301·000	315·400	·244	1·378
Saturn,	872,135,000	79,930	716·400	94·400	·132	·750
Uranus,	1,753,851,000	31,900	65·170	14·600	·226	1·280
Neptune,	2,746,271,000	34,700	85·880	17·050	·204	1·150

TABLE 2.—*Rational.*—Based on Theory of Gravity under consideration, in which the Force of Gravity increases to the Earth's Centre, by the law of inverse squares, and varies in a Mass as the Density squared.

	Distance from Sun in Miles	Diameter in Miles	Volume Earth's being Unity	Mass Earth's being Unity	Density Earth's being Unity	Density Water being Unity
Sun	0	853,737	1250000·000	627 500	502	2·284
Moon,	91,430,000	2,160	·020	·015	·748	4·235
Mercury,	35,393,000	3,010	·055	·060	1·098	6·215
Venus,	66,131,000	7,707	·919	·846	·920	5·203
Earth,	91,430,000	7,927	1·000	1 000	1·000	5·660
Mars,	139,312,000	4,247	·154	·131	·853	4·830
Jupiter,	475,693,000	86,520	1301·000	640·000	·493	2·790
Saturn,	872,135,000	70,930	716·400	260.100	·363	2·050
Uranus,	1,753,851,000	31,900	65·170	30·870	·470	2·680
Neptune,	2,746,271,000	34,700	83·080	37 820	·450	2·550

It will be observed that the irrationalities of the first table are in the last three columns. In these tables I have taken the Earth as 5·66 denser than water, the unit usually adopted by the Newtonian school of Philosophy. By that Philosophy, Saturn, a globe similar to our Earth, is much lighter than water, which is absurd. Saturn is a Cooled-Down World, and is just now passing through its glacial period, and to regard it as lighter than water in this stage is most illogical, and contrary to all physical analogies. Saturn as a Solid Globe resembling our Earth, must be at least two or three times denser than water; while the Earth is probably denser than 5.66. The Newtonian table gives Saturn as only three-fourths the density of water, and the Sun as only 1·41 that of water. Were it not that the Sun is a multiple body, with the constituent bodies not filling the whole of the space occupied, it would be the most dense body of the Solar System, and for the most part, and in respect to its solid portions it must be regarded as such.

In our last we announced that the *Sun was a Dynamo*, consisting of what might be regarded as a dual or triple world, possibly quadruple, in which the two central bodies forming the major portion of the Sun were in a state of oscillation, moving about each other in

what appears to be a rectilineal orbit, *the orbital period being* 1·1 *second of time*, the one body playing the part of armatures, and the other of field magnets, (though either may be regarded as armatures, and either as field magnets, since both possess equal momentums), and thus developing by induction positive and negative electricity, with their currents and discharge, and other products of electrolysis as oxygen and hydrogen, and thus giving rise to the solar light and heat. The main portion of the Sun is cool and solid, and the outer solid globe or body possesses, for the most part, a cool surface, compatible with being the abode of life. There are vast regions of the Sun at the base of the solar atmosphere in which the surface of the globe is so hot that life is absolutely impossible, yet for the most part in regions at the base but removed from the line of the central orbital oscillation, the conditions of temperature are compatible with life. We cannot boil a kettle of water with the fire only on the top and a circulation of air around, and the Sun's solid surface cannot be hot with the electric discharge and development of heat occurring only in the line of the oscillation, and in the photosphere above the atmosphere, with expansions of cold electrolytic vapours pouring into the latter from the underlying surface. Over the immediate line of oscillation of the central bodies of the Sun there will be regions of heat covering vast areas, in which the conditions for life are entirely absent. In considering the oscillations, the masses and momentums are so great that all distinctions of solid, liquid, and gas, practically disappear. The central solid globe or nucleus can oscillate in the onter enclosing solid globe as easily as if oscillating in a liquid or gas, probably easier. The exact form of the two oscillating bodies is a subject for calculation; they must not be regarded as two spherical globes, although the external of the two will approximate to a spherical form at the Poles. *All the stars are dynamos.*

I also announced that the twinkling of stars was due to interference in the stellar light, arising from magnetic double refraction of the light in transit through the Earth's atmosphere. Each original pencil of light coming from the star is broken up in our atmosphere into two pairs of circular rays, right and left-handed, whose resultant is two plane rays differing in phase according to the path pursued through the atmosphere and the amount and direction of magnetization, which latter is an ever-changing quantity, changing from moment to moment. In each pair of rays *the lower ray encounters a denser*

a'mosphere than the upper, hence the retardation giving rise to the interference and scintillation. Superposition of the interfering rays results from there being two magnetizations—*negative* and *positive*—possessing two distinctive refractive and dispersive indices. *Stellar scintillation is absent in the equatorial regions of the Earth, because there, magnetic polarity is absent, aud consequeutly magnetization and double refraction of the light is absent.*

I have now to announce a few facts regarding the Moon. *There is not a single volcanic crater in the Moon, and volcanos are conspicuous by their absence.* The structures on the Moon are so marvellously intact over the entire surface as to show that they have not been subjected to any such upheaving and destructive force as the volcano. Great heat evaporates ; lesser heat melts and levels down ; moderate heat, accompanying cooling, throws down as fast as it builds up,in respect to structural characteristics; and no development of heat in a world can build wall-like structures such as those of the Moon. One great earthquake, such as accompanies volcanic action, would throw them down, and volcanic action and earthquake over all the surface would throw them all down. There have been no volcanoes nor earthquakes in the Moon during the period when the present lunar structures were built. These structures are the work of animals, *i.e.,* the coral reef builders, they are attolic structures, which can only be formed where volcanoes are absent. The former presence of an ocean over the entire surface of the Moon has preserved the lunar structures wonderfully intact and free from atmospheric denudation, unless we except the older formations and a comparatively recent denudation by glacial action. The lunar structures are of calcium matter, carbonate and *selenium* or gypsum for the most part, and only resemble volcanoes and craters to lesser extent than that which prevails between the coral structures and volcanoes of the Earth. Owing to the entire absence of volcanoes and upheaving forces in the Moon its coral structures are more typical and true in character than those of the Earth ; but, except with respect to denudation and modification by crystallisation, in no other respect do they differ from the latter. Whitsunday Island in the Pacific Ocean is perhaps the most typical coral island of our Earth ; it resembles a volcanic crater, but in no respect is to be regarded as such, and Whitsunday Island resembles in form the most typical coral structures of the Moon. But Whitsunday Island is probably built on upheaved ground, while in the Moon the

coral structures rest on old sea beds, mostly plane or depressed, so that the lunar structures are less like a volcano or crater than Whitsunday Island. There are no chains of mountains in the Moon, such as are characteristic of volcanoes, but a grouping of the structures in a manner resembling that of the coral islands of the Indian and Pacific Oceans. *In the last stages of the Moon, as the atmosphere in disappearing became rarefied, bringing in the cold of space, glacial conditions prevailed over the entire lunar surface, producing the boulder and stone morraines constituting the streaks which radiate out from Tycho, Copernicus, Kepler, and other otollic basins of the Moon.* Glacial action may have formed some of the Rilles, but most of these are due to water action percolating through a calearecus soil, and are canons such as those of Colorado, and similarly formed.

The great prophet and leader MOSES asserted that Adam was the first man. Geologists have traced man into the glacial period of the Earth, but no further ; and, for the most part, regard the glacial period as having come to an end 200,000 years ago, asserting that man was upon the Earth at that time, thus denying the Mosaic record. Moses also asserted that, in the time of Noah, there had been an universal flood. Geologists, for the most part deny the latter, though since I first published my views on the Flood some have come round to a better mind. I have to repeat that the Glacial Period terminated with the flood of Noah, that the flood of Noah was universal, and that the approach to the Earth of the waters which caused the flood was the cause of the glacial period. The waters previous to the Flood lay above the firmament around the Earth, as rings or belts resembling those of the planet Saturn. These entered the Earth gradually before the Flood, bringing in the cold of space, producing a mist, which hid the Sun, and dropping as snow, piled up the ice on the higher latitudes of the Earth, and so caused the Glacial Period. Thus the antiquity of man is unproved, and the Mosaic record stands out triumphant. During the glacial period the mist was so great as to hide the Sun and prevent the formation of a rainbow. The fall of the rings upon the Earth to produce the Flood cleared away the mist, opened the windows and clouds of Heaven to the direct Sun, and thus the bow upon the cloud, seen by Noah and his friends for the first time, and the proof that no more waters enveloped the Earth, in space, became the guarantee that no more Flood should cover the Earth. It was the voice of God in nature, " I do set my bow in

the cloud," &c. Thus again the Mosaic record prevails.

Permit me to announce that the tides of the ocean are an effect of the Sun and Moon upon our atmosphere, producing barometrical changes commensurate with the effect, and not a direct effect upon the waters of the ocean, such as heretofore supposed. The waters are compressed out of the regions of high barometer, and rise into those of low, flowing away to form the tidal waves. From KEPLER's Laws it can be shown that the particles of the atmosphere next the Moon and Sun, like so many satellites, endeavour to describe elliptical orbits smaller than that described by the Earth round the controlling centres of gravity, and to move faster therein; hence they become piled up in advance of the Earth in the quadrant of low tide, creating a high barometer; which presses out the waters of the ocean. From the quadrant in advance of the Sun the atmosphere is abstracted, the result being low barometer and high tide. On the side of the Earth removed from the Sun and Moon the atmosphere is piled up in the region of low tide by an endeavour to pursue an enlarged elliptical orbit, hence results as before a quadrant of high and low barometer giving low and high tide. In short, *there are at all times on the Earth two regions or quadrants of low barometer, and two of high barometer, with two corresponding high tides and two low tides.* However much the barometer may vary locally, that is the average and general law of the barometrical changes, *the ocean is our barometer, the tides are its movements,* and measure the average barometrical changes due to the direct action of lunar and solar gravitation. Trade winds and storms are dependent upon this law, the greatest winds and storms accompanying the greatest tides. The temperature of the Sun is related to tides and winds principally by expanding the atmosphere, thus giving rise to the differential gravitational action resulting in the barometrical variations, tides, trade winds, and gulf streams. *To the great atmospheric movement deducible from Kepler's three great laws, and now detected in barometrical observations, we must assign the tides, trade winds, storms and gulf stream,* and the gravitation of the Moon and Sun must be regarded as acting to produce the various movements and currents of the terrestrial atmosphere and ocean, more directly than the Sun's heat.

Time and space will not permit me to dwell upon the matter, but I beg to announce that gravitation is due to the gyrations of ether and matter. The molecules of ether and matter impinging against each other lose gy-

ratory motion, *leaving an excess of motion in the approaching sides of the gyroscopes, which forces the impinging bodies together. The volume of the ether when subjected to pressure obeys the law of gases, viz., the density is proportionate to the pressure. Hence the ether density in a globe rises with the mass, and the force of gravitation rises with the ether density.* Let F be the force of gravity at the centre of a globe, M the volume, D the density of the matter, then

$$F = MD^2$$

or if we take a uniform density for the matter, then F is proportionate to the mass.

The sun contributes a considerable share of terrestrial gravity, and deflects the centre to the side of the earth next himself. The waters of the ocean endeavour to flow round the deflected centre of gravity, and the solid earth falls towards it, and at 12 o'clock noon and 12 o'clock midnight this deflection has raised the waters of the ocean. This action is so marked in the Pacific Ocean in the South Sea Islands, and the fact is so well established, that the word for high water and midnight is the same. *Gravitation may be regarded as directed to every point of space with a force proportionate to the density of the ether at that point.* The density of the ether at any point of space is determined by the contiguity or distance of matter from that point.

Space is filled with lines of force set up by the impacts of matter and ether. These lines of force may be regarded as radiating from the centre of a mass with a force proportionate to the mass into the density squared.

The value of gravity at every point of the Universe is determined by the entire matter of the Universe, and every molecule and mass contributes a share to that of every other, according to mass and distance. In the equations of the Planets their intrinsic variations of gravity must be taken into account, dependant on the approach and recession of external bodies. This action may be compared with induction. That point of the Universe which is nearest the mass of the Universe is not only the centre of gravity of the Universe, but *the point of greatest force of gravity.* This point is not necessarily situated in a mass of ponderable matter, but may be situated in open space. The density of the ether is greatest at that point, and galaxies of stars, and the motions of the whole universe are controlled from that point. Galaxies and individual stars may move through, near, and around it, pursuing almost rectilineal paths, at certain distances, with an intense and almost uniform velo-

city over an immense length of path, without being regarded as runaways, or they may circle in elliptical orbits around it, just as though there was another orb situated at that point. Sidereal systems and galaxies of stars widely separated may have within themselves such points of central force, resembling the central point of the universe. Many stars which appear to be circling around a dark invisible companion, may in reality be circling around such centres of force of gravity in free space. These stars may reveal where such controlling points of gravity are situated, and thus reveal the pivots of the galaxies and systems and perhaps that of the universe itself. The ether of space must be regarded as the source of gravity, and the great controller, gathered round, enfolding and controlling the ponderable matter of the universe, though of course the actions and reactions between the ether and matter are equal. The actions and reactions may be compared with electro-magnetic and magnetic induction.

For other results of J. Jones's researches see his books "The Sun a Magnet," "Undulation of the Sun's Nucleus," "New Selenography," and "Tria Juncta in Una," entered at Stationers' Hall, and deposited in the principal libraries of the United Kingdom. But since there are so many disputes as to who discovered certain things, or who wrote certain books, *e.g.*, whether Shakespeare or Bacon wrote certain plays ; from which we will quote, because foreshadowing gravitation—

> " Time, force, and death
> Do to this body what extremes they can,
> But the strong base and building of my love
> Is as the very *centre* of the earth
> Drawing all things to it."

Since the above is so, and there are so many JOHN JONES's, I beg to state and to place on record that your humble servant the Author of the above books and these announcements, first saw the light in a cottage which stood on the abutments of the famous iron bridge in Benthall, Broseley, Shropshire, on 5th February, 1851, and is the son of the late WILLIAM JONES, son of RICHARD and HANNAH JONES, son of WILLIAM and MARTHA JONES, of Orchard House—all of Broseley, and of MARIA PALIN JONES, his wife, daughter of JOHH PALIN and MARY FURBER PALIN of Sheriffhales, son of THOMAS PALIN and SARAH ADDISON PALIN, of Kinnersley, Shropshire—all of honoured and revered memory. Wishing all friends a "Merry Christmas and a Happy New Year,"

JOHN JONES, Natural Philosopher.
197 Princes Street, Dundee, Christmas, 1899.

Errata to Tables on page 36. Read for Sun, Table 1, *Irrational*—Newtonian.

Sun's Mass, Earth's being unity. 315000	Sun's Density, Earth's being unity. ·252	Sun's Density, water being unity. 1·444

Table 2, Rational, based on Theory of Gravity under consideration.

Sun's Mass, Earth's being unity. 627500	Sun's Density, Earth's being unity. ·502	Sun's Density, water being unity 2·284

These are the figures clearly shown as they appeared in the original announcement in the Dundee Evening Telegraph from which page the above is copied, but not very clearly shown in the copy on page 36.

For Saturn's diameter, Table I, read 70930 miles.

The following is from the Weekly News of Dec. 24th, 1898, imprinted with the original plate.

JOHN JONES'S
NINETEENTH CENTURY ANNOUNCEMENT.

GRAVITATION is due to a condition of the *ether* of space about matter. In a homogeneous globe that condition is greatest not at the surface, but at the centre. This holds for terrestrial gravity. The law of increase of attraction which prevails as the earth is approached from without its surface, *is continued all the way to the centre.* That law is the law of inverse squares. The cohesion of the globe and the unity of the system demand this law, and *pendulum observations confirm it.*

The sun is a multiple body or star, that is, multiple within its visible surface, and of which the central component is a large magnetic globe moving in an orbit about the centre of gravity of the solar mass in an orbital period of 1·1 second of time, or, that is, 54 complete revolutions or oscillations per minute. The orbital movements of the bodies within the sun are the source of the sun's light and heat. That of its central magnetic globe is the principal source. These movements are accompanied by intense electro-magnetic induction calling into existence the solar atmosphere and the solar energies of radiation. The everlasting orbital movements of the material bodies of the universe are the source of the everlasting radiations of the universe, the manner of operation being that of celestial approaches and collisions, these approaches being accompanied by electro-magnetic induction and the giving off of light and heat, and the collisions by a recreation of the system, with a sun or star for the centre. Every visible star in the heavens—planets excepted—is a multiple star similar to the sun, that is, consists of several bodies within its own visible surface possessed of distinct orbital movements; and the source of the star's radiation is the internal orbital movements of its component masses or globes.

Stellar scintillation is due to atmospheric double refraction, produced by magnetism of the star's light as it impinges on and transmits the atmosphere at a refracting angle, the magnetisation being by two mediums of our atmosphere, *negative* and *positive*, possessing different rotative and dispersive powers, and since the dispersions and double refractions of the two mediums are of opposite directions and different values, large portions of the spectrum colours of the star are superposed in interference phase. The intensity of terrestrial magnetism along the path of the star's light is varying every moment, and the character of the scintillation varies with it. The double refractions by terrestrial magnetism resemble those produced by prisms of right and left handed quartz.

J. JONES, Natural Philosopher.
197 PRINCES STREET, DUNDEE,
Xmas, 1898.

PRECESSION OF THE EQUINOXES.

143.—To enable an ordinary reader to take a simple view of precession of the Equinoxes. let N C S, Fig. 6 be the geographical axis of the Earth, N the North Pole, S the South Pole, W D E V the Equator, C the Earth's centre, P C A an axis of the Earth parallel to that of the ecliptic axis, that is to say, parallel to the axis of the Earth's orbit round the Sun, then precession of the Equinoxes consists of a rotation of the Earth on the axis P C A effected in 25000 years in the direction L D K V as shown by the arrows, and which rotation may be de-denominated a precessional day. This rotatation of the Earth in 25000 years alters the aspect of the heavens exactly the same as if the heavens rotated round the Earth in the contrary direction to the precessional rotation of the Earth, in this period of 25000 years, and which relatively they do.
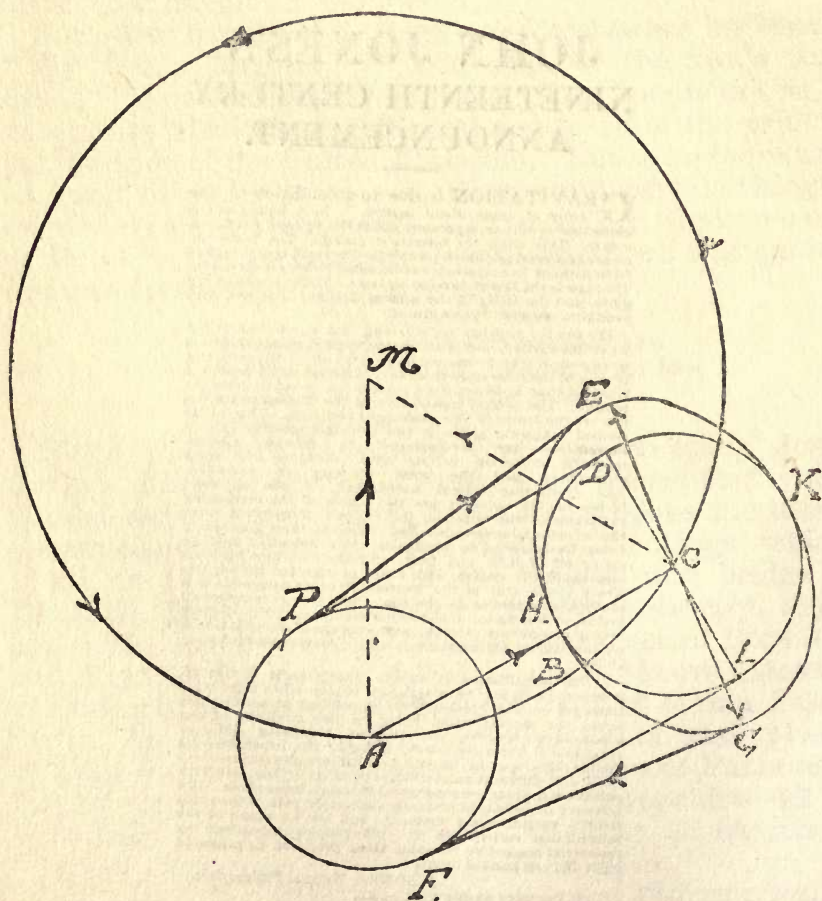
Fig.1.—Precessional, Tidal, & Secular Retardation force,

NUTATION.

144.—The plane of precessional rotation L D K V is subject to a slight change from time to time, as is also the velocity of the precessional rotation, the changes being recurrent and synchronous in the lunar period of 19 years, and the changes of place and change of velocity combined result in a slight change of the angle N C P, or which is the same thing L C E, these two angles being equal and varying together, a change overlapping or superposed upon the general precession of 25000 years. This movement is called Nutation, and affects the position of the Sun and stars only slightly in celestial latitude and longitude, i.e. only through a few seconds of arc.

PRECESSION AND NUTATION.

145.—Taken together Precession of the Equinoxes or movements of the nodal positions D and V (Fig. 6) where the Earth's equator WDEV cuts the ecliptic plane L D K V, and Nutation or nodding of the Earth's axis varying the angle N C P, or that is angle S C A, for these angles are equal and vary together, may be regarded as one phenomenon caused by the combined action of the Sun and Moon, both of which by their gravitation on the particles of the Earth's atmosphere, are engaged producing Precession, and both of which by their gravitation on the protuberant matter of the Earth's equatorial and tropical regions, (a protuberance which may be variable and related to tidal compress of the solid Earth and atmospheric and oceanic piling of air and water under the tidal forces, orbital, and centrifugal to the Earth's diurnal rotation) are engaged producing Nutation, just as both are engaged producing the tides of the ocean, which oceanic tides are really due to the forces which produce Precession and Nutation, and in reality are the reaction of the ocean waters from the Precessional movement and Nutation o! the solid Earth, the recoil of the atmosphere from tne Precessional impact, and its inertia in respect to the movement of the solid Earth in Nutation, urging the ocean into its tides.

146.—But consequent upon the diurnal rotation of the Earth, that of the solar day of 24 hours in the direction W D E V not shown by arrows in Fig. 6, though shown by arrows in Fig. 2, it follows that Precession and Nutation, are not quite so easily understood and their principles embraced as 144 and 145 and Fig. 6 would lead the reader to suppose. And in dealing with these mat-

ters which are such as have baffled the combined wisdom
of the world since the creation to the present moment,
including all the ancient astronomers, and the greatest
of minds and intellects of more modern times, embracing
names such as those oi Copernicus, Galileo, Kepler,
Newton, Adams, we say, that in dealing with these deep
matters, we ask the forbearance of our readers, and their
patient consideration, and ask them to suspend their
judgment upon the points involved, until they grasp the
general expression of what we have to say, and not even
then to suppose that we have said all that we know upon
the subjects.Let it suffice,that,if in the general elucidation
we shall have been enabled to indicate and place upon the
proper basis, the broad general facts and principles of
the Atmospheric Circulation, Oceanic Tides, Precession
of the Equinoxes, Nutation of the Earth's Axis, and the
Secular Retardation of the Earth's diurnal rotation,
principles fraught with consequences to the inhabitants
of the world only secondary (if they are secondary) to
those which the annunciation of the Copernican system
involved, the system which asserted that the Earth
went round the Sun, in contradistinction to previously
conceived notions and received opinions of both the
learned and unlearned.

147.—But to proceed. If we regard the Precessional
rotation, the rotation of the Earth effected in a preces-
sional day of 25000 years on the axis P C A Fig 6, in the
direction L D K V as being due to a rush of the matter
of the atmosphere *en masse* round the Earth in the direc-
tion L D K V, round circles of celestial latitude on the
Earth parallel to L D K V, and with a momentum and
velocity proportionate to the magnitude of these circles,
but with a resultant along the great circle L D K V, and
to such which rush the precessional rotation is evidently
due, then this rush is taking place over the Earth as the
latter rotates in the direction W D E V in the solar day
of 24 hours, which diurnal rotation is almost directly op-
posed to the rush of the atmosphere which gives rise to
the rotation constituting the Precessional day, hence
ensue modifications and complications which have to be
considered.

148.—Up to this point in dealing with precession; Fig. 6
will suffice for illustration, but we must now pass to
Fig. 2 correspondingly lettered to Fig. 6 in respect to the
same parts, (a method pursued as far as possible for all
the figures,) but drawn aud lettered to embrace much
more of the phenomena, and requiring all the letters of

the alphabet to indicate its various functions, and enable it to be used for elucidating the subjects. This figure may be regarded as the alphabet or A B C of the subjects treated, and as an ordinary alphabet is capable of universal adaptation for descriptive purposes, so it is hoped that this figure may provide very extensive applications in illustration of the subjects treated.
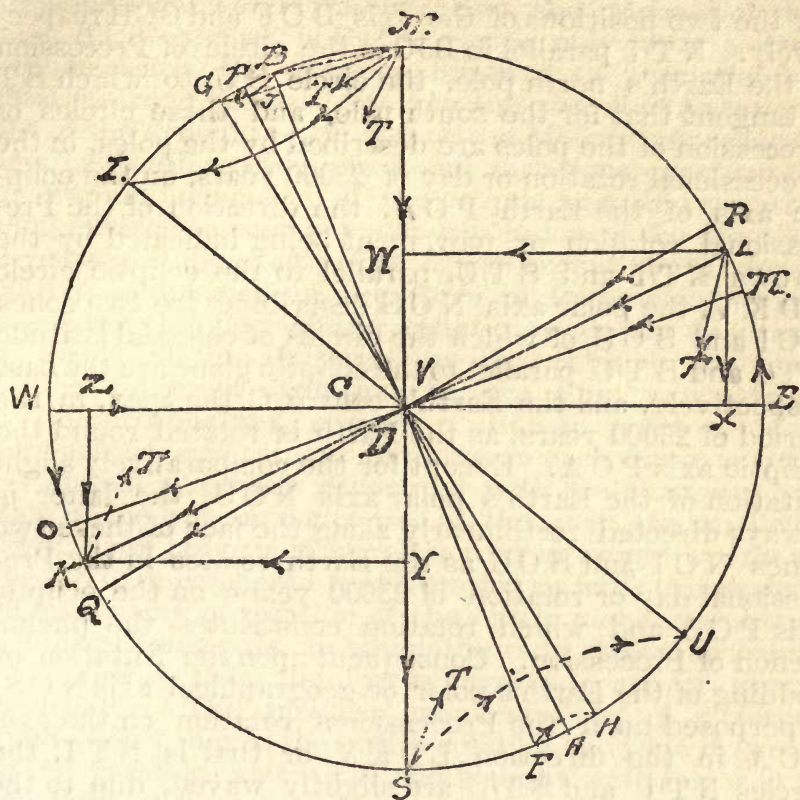
FIG. 2.

N S the Geographical axis, N the North Pole, S the South Pole, W D E V, the terrestrial Equator rotating from west to east, P A the axis of Precession, B J G or that is L D K V the direction of the Precessional rotation on the Ecliptic axis P C A, P C A the Ecliptic axis, K D L V the plane of the Ecliptic circle, N T/I the path of the North Pole in the Precessional rotation, S T/U the path of the South Pole in the Precession.

149.—As before in Fig. 6, so in Fig. 2, N C S is the geographical polar axis, C the Earth's centre, W D E V the terrestrial equator P A the ecliptic axis of the Earth, K D L V a great circle of the Earth in the ecliptic plane or plane of the Earth's path round the Sun, or relatively of the Sun's motion round the Earth, but B C F and G C H are two axes of the Earth, parallel to two positions of the axis of the lunar orbit removed half a

lunar period or synodical revolution, or about $9\frac{1}{2}$ years apart or to be exact 3397 days apart, or that is parallel to the axis of the Moon's orbit about the Earth or Earth's orbit about the Moon, or that is, parallel to the axis of the orbits of both bodies about their common centre of gravity. OCM and Q C R indicate great circles of the Earth in the plane of the orbit of the Moon and Earth for the two positions of the axis B C F and GCH respectively. N T'I parallel to BJG is the circle of Precession of the Earth's north pole, the circle S U to which S T is tangent that for the south pole, and these circles of Precession of the poles are described by the poles, in the Precessional rotation or day of 25000 years, on the ecliptic axis of the Earth P C A, the direction of the Precessional rotation or movement being indicated by the arrows N T'I and S T'U, parallel to the ecliptic circle L D K V, the polar axis N C S describing the two cones N C I and S C U of which the circles of celestial latitude N T'I and S T'U parallel to the ecliptic plane are the base respectively, and the Earth's centre C the apex, in the period of 25000 years, as the Earth is rotated round the ecliptic axis P C A. Except for the comparatively slight nutation of the Earth's polar axis N C S, the latter is always directed rectilinearly along the face of these two cones N C I and S C U as the Earth rotates in the Precessional day or rotation of 25000 years, on the ecliptic axis P C A and which rotation constitutes the phenomenon of Precession. Consequent upon the Nutation or nodding of the Earth's polar or geographical axis N C S, superposed upon the Precessional rotation on the axis P C A in the direction L D K V or that is N T'I, the circles N T'I and S T'U are slightly waved, due to the variation of the angle N C P or that is S C A now increasing now decreasing, according as the tangent N T is directed inwards or outwards of the circle N T'I, a condition dependent upon the position of the pole of the lunar orbit in the circle B J G, and the plane of the lunar orbit in the circles R D Q V and M D O V about the ecliptic, the tangent N T being directed inwards when the pole of the lunar orbit is at B and outwards when the pole of the lunar orbit is at G, as the axis of the lunar orbit B C F or G C H revolves round the ecliptic axis P C A, in a synodical revolution of the Moon of about 19 years or to be exact 6793 days, the angle B C P or G C P equal to L C M or R C L being about $5\frac{1}{2}°$, and this being the inclination of the plane of the lunar orbit M C O or Q C R to that of the ecliptic and so of the lunar

tidal circle MDOV or RDQV to the solar tidal circle LDKV and circle of lunar precessional force R D Q V or M D O V the latter shown in two positions at intervals about 9 years apart, the ecliptic plane bisecting the two positions making angles of $5\frac{1}{2}°$ and so near to them, that approximately it may be regarded as the precessional circle or Tidal Circle to both Sun and Moon, but the angle N C P or that is S C A varies only over a few seconds of arc, the extreme limits of the variation by Nutation being less than 19", and the period of Nutation, that of the synodic revolution of the Moon, comprehending all subsidiary oscillations and variations; a return to the original inclination of the ecliptic axis and equator being effected in each synodic revolution of the Moon of 19 years or to be exact 6793 days; except for a slight relative diminution in the force of Precession which causes the obliquity of the ecliptic to slowly decrease by about 8" in 19 years by the relative increase of the force of Nutation of the Sun and Moon on the protuberant equator. But in point of fact there are several minor nutations in each lunar month, and annual nutations connected with the changing position of the Sun in the course of the year, the smallest of which are important in relation to tides and weather. When it is remembered that Nutation as with Precession is a movement of rotation of the entire globe generated on a momentary axis in which the radii are evanescent, it is evident that the forces involved, are of great magnitude. The smallest manifestations of a force which visibly moves the entire solid globe is one deserving the greatest attention, and fraught with important consequences in meteorology and kindred sciences.

150.—The force which effects Precessional rotation in respect to the Sun is a force directed round the ecliptic circle L D K V of the Earth, in the direction shown by the arrows on this circle, and is due to the orbital force of 19—24, 54, the force illustrated in Fig. 1, represented by the velocity P E—P D or A C, and A C or F L—F G. This force may be regarded, in presence of the Earth's diurnal rotation, as having two rectangular resultants in two rectangular planes the one resultant N D S V, Fig. 2, directed round a meridian great circle of the Earth as shown by the arrows on N D S V, and passing through the geographical poles N and S, the other resultants directed round the Earth in the plane of the terrestrial equator; in a direction E D W V that is, due east to west, in a direction

that of the Secular Retardation of the Earth's rotation, a retardation which, there is reason to believe, accompanies the observed secular change of the advance of the Moon in its orbit or longitude. In the figure the two components of the force L D K V are shown by the pair of arrowed arcs over the sines L X and Z K, and the pair arrowed arcs over the cosines L W and Y K respectively, the sines being proportionate to their arcs, representing the components of the one resultant, the cosines the components of the other resultant, and these sines and cosines may be taken as expanded to represent circles in their own planes, returning arrowed in reverse direction with respect to space, and north and south on the other side of the figure, though in the same direction with respect to east and west, so as to represent a tangential impact or rotation of which the great circles N D S V supposed to be arrowed continuously round the sides of the figure in the directions named and indicated by this sequence of the letters, are the respective resultants. It is not convenient to arrow the direction E D W V for the Secular Retardation that is from east to west, because this circle of the equator is arrowed in the opposite direction W D E V to represent the diurnal rotation, but the cosines L W and Y K or their arcs regarded as portions of circles on the side next the observer of the figure, are arrowed to show the force E D W V which produces the secular retardation. It may be more convenient to regard L X, Z K, L W, Y K, as radii to circles in their own planes, which circles may then be taken to represent the forces N D S V and E D W V respectively, but these circles will be to each other in the ratio L X is to L W. Since as shown in the figure, the two resultants of the whole force, acting along the two great circles, N D S V and E D W V as produced round the whole Earth, are to one another in the ratio L X is to L W, that is, in the ratio Sine N C E is to Cosine NCE, that is, as Sine obliquity of Ecliptic is to Cosine obliquity of the Ecliptic, these are the respective velocity ratios of the resultants N D S V and E D W V of the movement and impact of the atmosphere under the orbital force of 19—24, 54 and Fig. 1, directed in the Tidal Circle, L D K V, the great circle of the Earth in the plane of the ecliptic, a movement of the atmosphere directed against the ocean waters and solid Earth, and producing by friction, impact and momentum of the air against the waters and solid Earth, the PRECESSION OF THE EQUINOXES and the SECULAR

Retardation of the Earth's Rotation, the direction L D K V being exactly true in respect to the action of the Sun, and only departing from the direction shown, L D K V, by an amount not exceeding $5\frac{1}{2}°$ in respect to the action of the Moon, the amount of the inclination of the plane of the lunar orbit to that of the ecliptic, the plane of the action of the Moon and its direction varying between R D Q V, and M D O V according as the pole of the lunar-terrestrial-orbital-axis is at B or G.

151.—The resultants N D S V and E D W V are on the average for both bodies the Sun and the Moon, directed through D and V the nodes of the ecliptic plane L D K V, and equatorial plane W D E V and the figure under consideration Fig. 2 is taken as being in the solstitial meridian plane N W S E, with the node D in front at the centre of the figure, and the node V behind the figure, D C V being the nodal diameter of the Earth, and W C E a solstitial diameter rectangular to D C V.

152.—Precession of the equinoxes as modified by the Earth's diurnal rotation of 24 hours, consists of a rotation on the axis P C A regarded as a momentary axis with evanescent radii, but none the less a real rotation on the axis P C A in a precessional day of 25000 years, but consequent upon the radii being evanescent, and the conflict with the Earth's diurnal rotation, and the necessity of continually changing the plane of the latter, requiring a continual manifestation of force, and is a rotation without an acceleration of velocity, just as a planet subjected to having its tangential force destroyed in each quarter-revolution of the orbit, requires that the primary orb continually put forth force of gravitation to maintain the velocity of the planet, and yet the latter has the period of its orbit neither increased nor decreased, that is its average velocity is neither increased nor decreased, and yet its orbital velocity is performed by a force of average uniform acceleration or equivalent thereto.

153.—Precession and Nutation regarded as one phenomenon, consists of the simultaneous rotation of the Earth on two axes, the solstitial W C E, and the nodal D C V, superposed upon the 24 hour diurnal rotation on the polar axis N C S.

154.—Thus in respect to Precession, Nutation, and Secular Retardation the Earth must be regarded as simultaneously rotating on three rectangular axes, (1) the geographical, or polar axis N C S, (2) the solstitial - meridional -equatorial axis W C E that of the Pre-

cession, (3) the nodal-meridional-equatorial axis D C V̇ that of the Nutation, and this it actually is doing and by the action of three forces or resultants in the three planes, or that is by the orbital force 19—24, 54, Fig. 1, and gravitation of the Sun and Moon on the equatorial protuberance.

155.—But we have seen that orbital force 19—24, 54, and Fig. 1, and impact friction and momentum of the atmosphere under that force, can only produce the secular retardation by the cosine of the obliquity of the ecliptic components L W, Y K, or the resultant E D W V, a negative rotation of the Earth from east to west, (that is, if we regard the diurnal rotation which is from west to east as positive) and a rotation N D S V on the solstitial axis W C E, the latter of which would speedily make the obliquity of the ecliptic 90° by rotating the axis of the Earth into this plane. Hence manifestly there is a third force at work rotating the Earth in the direction E M L N produced round the Earth, that is to say, rotating the Earth on the nodal-meridian axis D C V in the direction E M L N, and so on the average reducing the angle N C P as fast as the rotation N D S V increases it. It is the two rectangular forces N D S V and E M L N alternately preponderating which produces the Nutation of the Earth's axis, by varying the angle N C P, or that is is the inclination of the ecliptic plane L C K to that of the equator E C W.

156.—The question arises, what is the solstitial-meridional force E M L N or W O K S which limits and determines the angle of the obliquity of the ecliptic and maintains it on the average at 23° 27′, and by its alternation, with the force N D S V produces the Nutation of the Earth's axis, a force E M L N balanced against the force N D S V? and the answer is manifestly the attraction of the Sun and Moon on the protuberant equatorial matter of the Earth, and greatest when these bodies come to the solstices or that is attain their highest declination in either hemisphere as they make their orbit round the Earth and *nil* when they are in conjunction at the nodes D and V.

157.—The force of gravitation of the Sun and Moon·which acts on the protuberant matter of the equator and tropics, acting alone, would remove the obliquity of the ecliptic altogether, by drawing down the equatorial protuberance W D E V into the ecliptic plane K D L V, and this it would do were the Earth entirely a solid mass and possessed of no atmosphere, whether the Earth were

stationary or possessed of diurnal rotation as at present.

158.—The atmospheric impact L D K V of orbital force 19—24, 54, by rateral recoil from the protuberant equator would speedily bring the polar axis N C S into the plane of the equator N D W, so that the diurnal rotation W D S V and the orbital force movement of the atmosphere in the Tidal Circle L D K V should coincide as a plane of least resistance and stable equilibrium, did not the force E L N the attraction on the protuberant matter of the equatorial and tropical regions limit this action. Thus the particular angle of obliquity of the Earth and a planet to its path about the primary, is determined by atmospheric-precessional- tidal-nutational force acting on a solid globe.

159.—Precession then of the equinoxes is due to a nodal-meridional force N D S V directed on the average in this plane, in the direction shown by the arrows, while Nutation is due to the conflict of this force with the effects of solar and lunar gravitation on the protuberant matter of the Earth's equator and tropical regions, a force indicated by the arrows on E N W S, in this plane.

160.—The precessional rotation on the axis P C A would still exist were the Earth a perfect sphere and possessed of no equatorial protuberance and possessed of no diurnal rotation, by friction of the atmosphere under the orbital force of 19—24. 54, urged round the Earth in the Tidal Circle, L D K V against the waters of the ocean and the solid Earth, but the Precessional rotation would then be accelerative until the Earth acquired a high velocity of rotation from east to west on the axis P C A.

161—But in the absence of the diurnal rotation the whole force L D K V would be engaged rotating the Earth on the ecliptic axis P C A and instead of a Precession effected in 25000 years, the Precessional rotation would be effected in a very much shorter period, and one continually shortening, because at present, of the whole force 19—24, 54, P E, G F of Fig. 1, L D K V of Fig. 2, there is engaged a portion producing the Secular Retardation, and calling the whole force *unity*, the quantity engaged producing Precession equals Sin^2 obliquity of the ecliptic, equals Sin^2 23 27′ that is ·158363, and that producing Secular Retardation equals Cos^2 23° 27′ that is ·8416.

162.—We take the kinetic energy or pressure of the atmospheric movement that producing Precession and Secular Retardation as the square of its velocity, because atmospheric pressure in a wind varies as the square of the velocity, and atmospheric pressure under the orbital

force of 19—24, 54, P E G F of Fig. 1, L D K V of Fig. 2,
is a force of the character of wind movement, and acting
in the direction L D K V is the cause of the Precession
of the Equinoxes, and also of the Secular Retardation of
the Earth's diurnal rotation, these phenomena arising
from the two rectangular resultants or velocities of the
force L D K V respectively, which therefore are to each
other as Cos² obliquity is to Sin² obliquity.

163,—This kinetic movement of the atmosphere reaches
directly down to the surface of the Earth in the trade
wind zone, and produces kinetic and dynamic energy of
the trade winds by direct action, an action prevailing in
the equatorial regions between the circles of latitude of
30°, that is, over half the globe, while recoil therefrom or
reactionary currents prevail in the latitudes beyond 30°
and largely give rise directly to the anti-trade winds.

164.—But the trade winds are really produced not only
by direct action of the force L D K V, and the anti-trade
winds, not only by recoil of the air moved by this force,
as it makes impact with the ocean waters and solid
Earth, but combined with and chiefly by outflow of air
from the Tidal Circle, from the tropics of Cancer and
Capricorn, as given in arguments 19—24, 54, and their
context, while if we take into consideration the inflow of
air into the Tidal Circle and tropics to replenish the out-
flow and embrace the whole atmospheric circulation, then
the atmospheric circulation regarded dynamically is ex-
pressed by the forces, directions, and amounts of Preces-
sion and Nutation, and kinetically and barometrically by
the tidal movements and currents of the ocean waters.

166.—We are now in a position to calculate the amount
of Secular Retardation of the Earth's rotation, and give
the quantity, so that this quantity may be used in calcu-
lating the secular advance of the Moon in longitude, in
so far as this is due to the Secular Retardation of the
Earth's rotation. The observed advance of the Moon in
longitude is about 12″ of arc in a hundred years, and for
larger periods this quantity multiplied by the time
squared, thus in two centuries it will be 48″, in three
centuries 108″ and so on. Of this advance about the
half is believed to be due to the Secular Retardation of
the Earth's diurnal rotation, a retardation accelerative
as the time squared in the same manner as the Moon's
advance in longitude. But 6″ of advance of the Moon in
longitude represents a retardation of the Earth's meri·
dian of 6″ × 27.32, because the Earth rotates in angle,
this much faster than the Moon moves in its orbit, there-

fore the unexplained advance of the Moon in longitude, represents a retardation of the Earth's diurnal rotation of 164$^{\prime\prime}$ of arc in a century, or 656$^{\prime\prime}$ of arc in two centuries, or 1476$^{\prime\prime}$ of arc in three centuries, and so on, superposed upon the sum of the diurnal rotations. That is to say, at the end of one century, the total loss of longitude of a meridian of the Earth, the sum of the retardations on every rotation, will for the whole century, be 164$^{\prime\prime}$ of arc. Let us see how this supposed quantity compares with the actual amount of retardation, as now to be calculated from the Precessional rotation, whose force compared with that of the secular retardation equals Sin^2 obliquity of ecliptic is to Cos^2 obliquity of the ecliptic, that is as L X^2 is to L W^2 Fig. 2. The force L X Fig. 2 equals Sin^2 cbliquity of the ecliptic that is .397949^2 and gives one complete rotation of the Earth on the ecliptic axis P C A in 25000 years. Then the value of L W is found from the ratio Sin^2 23°27$^\prime$ is to Cos^2 23°27$^\prime$ that is .397949^2 is to .917408^2 therefore .158363 is to .841634 as one rotation of the Earth in 25000 years is to T, where T is the number of diurnal rotations lost by the Earth in the Secular Retardation in 25000 years. It follows that in 25000 years, consequent upon the Secular Retardation due to the atmospheric movement which produces the Precession of the Equinoxes, the Earth makes 5.3 diurnal rotations in this period, less than it would have made had this retardation not existed, and the Earth's diurnal rotation been constant in velocity, and not subjected to retardation.

167.—Expressed in retardation for 100 years, in seconds of arc, we have ·53$\times$360°$\times$60$^\prime\times$60$^{\prime\prime}$ divided by 250^2 equals 110$^{\prime\prime}$ of arc that arc by which a meridian of the Earth falls behind the Moon in 100 years, by reason of the secular retardation, and if the time be expressed by T centuries, then 110$^{\prime\prime}$ T^2 is the retardation for any period of time. This 110$^{\prime\prime}$ the now calculated retardation compares with 164$^{\prime\prime}$ the unexplained part of the Moon's advance in longitude.

168.—But momentums have to be satisfied, and when we consider the action of the Moon in producing the secular retardation, the Moon and the Earth form a conservative system of force, in which the algebraic sum of the momentums of the rotations and orbital motions is constant, and after all other effects have been considered, if there is still an unexplained part of the Moon's advance in longitude, we must assign this to reaction upon the Moon and Earth of the orbital force of 19—24,54,

that is reaction from Precession, Atmospheric Circulation, and Tides, as produced by the Moon, and they are so produced in the ratio of about 5 is to 2, where 5 is the lunar force, and 2 is the solar force, and these combined forces produce the whole result. That is to say, the velocity of Moon and Earth in the orbit about each other must be quickened, and their momentum increased by reaction from the precessional and tidal effects upon the Earth, by an amount equal to the momentum of diurnal rotation lost by the Earth. And when this is taken into account the whole unexplained advance of the Moon of $6''$ of arc in a century is now fully accounted for.

169.—In all questions of reactions on bodies wide apart in space such as the Earth and Moon, the planets and Sun, not simply volume mass, or quantity of matter must be taken into account, but also density ; and gravity and inertia must be regarded as varying with the density, and *inertia* and *gravity* as varying together, so that a body possessing small central force of gravity and moving in a field of feeble force of gravity must move relatively faster to obtain a given momentum than if it formed part of the mass of a larger body. Thus at the surface of the Sun, by the action of solar gravity, bodies fall 25 times more rapidly than upon the Earth, but as inertia in the Sun is 25 times greater than upon the Earth, and weight also 25 times greater, the actual energy of the fall or momentum is not 25 times what the Earth's force of gravity can confer in unit time, nor 25^2 but measured by energy evolved and work done on unit mass, the minimum view of the force of gravity at the surface of the Sun is 25^3 or 15625 times greater than that at the surface of the Earth, while if we take into account that each unit of the work is done in a very much shorter time than on the Earth, the unit 25^4 is not too high an estimate of the force of gravity at the surface of the Sun, or 314000^4 at 4000 miles from the centre of the Sun, a force almost too great for the mind to grasp, but a force fully required by the mechanical energies engaged evolving the solar radiation of light and heat. Or if we say that kinetic energy of unit mass under gravitational fall varies as the square of the velocity on Earth, then when we take variations of velocity by gravitational fall in different globes, kinetic energy varies as v^4, since the force which can produce a velocity of 25 in the Sun, would consequent upon diminished force of inertia in the Earth, produce a velocity of 625 on the Earth, or a kinetic energy of 625^2 equal to v^4 or that is velocity to the

fourth power. But we may deal with this later on.

170.—We must not here digress any further in the way of pointing the road to the new laws of motion as required by, and following upon the discovery that *gravitation is a central force, a variable force, and produced by gravitative influence of the particles of the mass upon each other and the field in which they lie,* in a manner resembling that cf magnetic induction; but since in respect to attraction of mass for mass, it is usual to take a magnet as the type or analogy to gravitation, now that so much is known of magnetism, will it not be proper to regard almost its every attribute as the type of corresponding features of gravitation, so that just as we have magnetic induction or influence of the particles upon the axis or centre of the magnet producing there a central force,—or for that matter we may take the electrical helix as the type, and then we obtain ether influence and magnetism producing a central force,—so we have gravitational influence or induction generating the central force of gravity in a mass, and then gravitation at a distance, and cohesion of contact, resemble magnetism at a distance and magnetism of contact.

171.—Personally we are persuaded that the laws of electricity and magnetism in relation to the mass or masses of matter and influences concerned, are in a sense the laws of gravitation in relation to the mass.

172.—Heretofore gravitation has been considered as "a feeble force requiring bodies of the size of planets to manifest it," and so it would be did it vary simply as the acceleration, but when it is regarded as varying in different planets and globes as the *acceleration cubed* (or as the fourth power of the acceleration if we regard kinetic energy as proportionate upon the Earth to velocity squared) and regard it as a central force whose amount varies with the density of the mass inversely as the distance squared of the mass from the centre multiplied by the rise of the influence of the particles upon each other, and upon the centre with that rise, as they are compressed in density upon each other and upon the centre, then gravitation instead of being a "feeble force," becomes THE GIANT OF THE UNIVERSE, quite capable of controlling the electro-dynamic-magnetic movements and conditions of the two internal globes or masses of the Sun which by their movements form the 1.1 second oscillatory or rotatory electro-magnetic-solar dynamo, and quite capable of controlling the mechanical solar energies, as these are engaged developing the light and

heat of the Sun, which light and heat does not pervade the entire solar mass, making it a hot body throughout, giving off light and heat by a general cooling, but which light and heat is produced by the mechanical movements of two comparatively cold and magnetic bodies, composed of ordinary material in the Sun combined with magnetic matter, developing electricity and the products of electrolysis, and combustion of electricity and the products of electrolysis in the photosphere.

173.—But notwithstanding the vast energies in the Sun, and they are millions-fold greater than ever heretofore supposed, the Sun is a conservative system of mechanical forces, and none of the momentum of the two opposed motions in the Sun, that is of the two masses forming that body and in a state of collision or a state resulting from the collision of two great bodies, none of this momentum, and none of the energy thereof can disappear, neither can the 1. 1 second period of oscillation or of central oscillation and rotation alter, except by radiation of light and heat into space, or by change of temperature of the Sun by change of density by expansion or contraction, (effects which are certainly occurring in too comparatively feeble degree to affect the value of the oscillating period in any appreciable degree over wide intervals of time) and while electro-magnetic-dynamic dissociation of positive and negative electricity and of the chemical elements of ordinary matter occur on a vast scale throughout the entire mass of the Sun, especially in the more cool and solid portions of the two central oscillating masses, each of which is a globe or mass thousands of times larger than our Earth, electric discharge and chemical combustion occur in the photosphere on the most gigantic scale (though the underlying oceans and crust are kept cool by the electric and vapor expansions and eruptions),yet there are electric current returns and electro-magnetic returns which sustain the mechanical conditions, of the internal oscillation or oscillatory-rotation, except in so far as the solar energies are radiated into space.

175.—The greatest force of gravity anywhere in the solar system under the Newtonian views of gravitation is only 25 times that of the force of gravity at the surface of the Earth, and altogether inadequate to control the mechanical energies of the Sun, and account for the intensity of its light and heat, a radiation resulting from these energies, which light and heat and radiation is as immediately developed from day to day, and from year

to year from the mechanical motions, and is as new a creation as the harvests produced thereby. The originating mechanical motions giving rise to the solar radiation, are not etherial, are not molecular, but motions of translation, and rotation of two material masses, which together form the entire mass or major portion of the Sun; and are both for the most part cool solid bodies. The heat and light of the Sun producing this year's harvest may be said to have had no existence last year as temperature in the Sun, but only a mechanical existence, viz., that of the movements of the two great masses of matter forming the Sun, which by their relative motions, and endowed with magnetism, and acting inductively on each other and by friction, are thereby giving rise to the solar radiation as a result of the internal electro dynamic and mechanical energies all controlled by the central force of solar gravity, and constituting the Sun an electro-magnetic dynamo, differing only in scale and the perfection of its parts, purposes, and adaptabilities from the electro-magnetic-dynamos of our physical laboratories, electrical engineers, and light installations, and surpassing these as much as the glory of the heavens surpasses that of the Earth, or as much as the magnitude and dignity of the Earth, surpasses that of a grain of sand.

176.—Until the Newtonian views of gravity are largely abandoned and entirely revised, and it is recognised that gravitation is a central force and increasing to the centre of a mass at least by the law of inverse squares, or under a proper view of the laws of force, varying at least inversely as the fourth power of the distance from the centre all the way to the centre, until this is recognised, the inhabitants of this world will never understand why the Sun shines, and the intensity of its radiation.

177.—A magnet or an electro-magnet and a piece of soft iron pull each other with equal force, but the pull by the soft iron on the magnet is derived from the force of the latter. We may compare the pull with that of a ship's engine by means of a cable pulling a boat to the ship. Action and reaction are equal, but the fuel on the ship does the work. There is no force in the boat but what is thrown into it from the ship, similarly while under the influence of the magnet, the soft iron will pull other iron to itself, but not with a force simply proportionate to its mass; but also dependent upon distance of the magnet from which it receives its force; simil-

arly the pull of 1lb of matter on the Earth when at the surface of the Earth, though it is 1lb, it is derived from the whole force of gravity in the Earth, whose resultant is the central force of gravity, and the 1 lb of matter will pull other matter than the Earth towards itself, and its matter will cohere, but not with a force simply proportionate to its mass, but also dependent upon its distance from the Earth's centre. Thus, however many pounds of matter we aggregate and weigh at the surface of the Earth towards the Earth, if we do not change their distance from the influencing Earth, we do not alter the result, but only sum the Earth's force, in respect to the units of matter acted on by the Earth, neither do we determine the laws of gravitation in respect to aggregation of mass, and to assume that we do so, as does the Newtonian system, is only to beg the question; the laws of gravitation unless our methods become more refined, can only be deduced from the motions of planetary masses and their influence and perturbations upon each other at different distances, or by effects of cohesion under different compresses. The Earth and Moon possess less force of attraction for each other for a given distance apart, when at aphelion of the Earth's orbit than when at perihelion, consequent upon receiving a decreased quantity of mutual influence; and also for external matter generally; and this effect must be considered in determining the exact form and dimensions and period of the orbit about each other at different portions of the year, an effect which must be classed under perturbations of the orbit. We must look upon all the orbs of space as moving in different densities of ether, and regard the density as rising with the aggregation of matter, and regard the central force of gravity of each orb, as rising with the density, and we may also regard the density of ether as affecting the velocity of light by a law such, that in the interstellar spaces, while the elasticity is exalted the density is reduced, so that in the interstellar spaces light travels with an immensely greater velocity than it does in the solar system. That part of space toward which the force of gravitation acts with the greatest power, is the part where the velocity of light is least, and that part of space towards which gravitation is most feebly directed is the part where the velocity of light is greatest. Hence light comes from the most distant star in an almost incredibly short space of time, and with an almost incredible velocity as compared with its velocity when transmitting the solar system, great as is the latter.

178.—But to return to the primary subjects of this treatise viz. Atmospheric Circulation, Oceanic Tides and Currents, Precession of the Equinoxes, Secular Retardation, and Nutation, all of which are now ripe for solution, and the immediate placing thereof, upon a true and practical basis, adapted for all purposes of utility connected therewith; that is to say, the time is now ripe for rendering the knowledge of these things an exact science, and to lead to this result, is one of the objects of this publication.
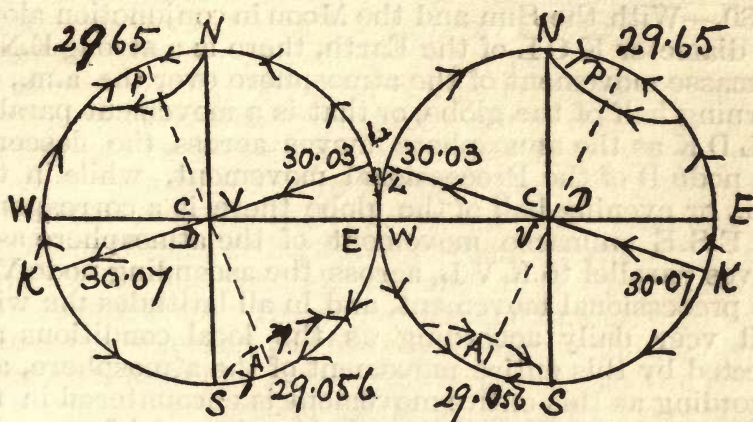
FIG. 3.

Correlation of the barometrical pressure on the globe with the force which produces Precession of the Equinoxes, Secular Retardation, and Oceanic Tides and Currents.

179.—In Fig. 3 lettered as in Fig.'s 1 and 2 the two barometrical maximums of the atmosphere are shown in the tropics resting on the highest declinations attained by the Tidal Circle L D K V the circle of orbital force of Fig. 1, the circle of the Precessional and Secular Retardation force ; and the oceanic tides and currents stand in relation to the rotation of the Earth carrying the various regions of the Earth towards or from the maximums L and K, and to the winds going forth over the surface of the Earth from these maximums and into the corresponding barometrical minimums or relative minimums at or near quadrature with L and K on the meridian in which L and K are situated, L D K V the Tidal Circle or orbital force circle as arrowed represents the direction of the *en masse* movement of the atmosphere by the orbital force 19—23, 54 and Fig 1, and bisects the movement of the atmosphere in the North and South ecliptic hemispheres, a movement which extends all the

way to the Ecliptic or Tidal Poles P and A, in parallel circles to L D K V of decreasing length towards the Poles P and A, that is circles of ecliptic or tidal latitude, the precessional or secular retardation force or movement of the atmosphere in respect to each circle varying as the square of the length of each circle, and the force and movement of the atmosphere, the en masse movement, attains the highest velocity along L D K V, and has its average resultant in the ecliptic plane along the direction L D K V, or that is along the plane of the Earth's orbital motion about the Moon and Sun.

180.—With the Sun and the Moon in conjunction along the diameter K C L of the Earth, there is a strong E.N.E en masse movement of the atmosphere over the a.m., or morning half of the globe, or that is a movement parallel to L D K as the atmosphere moves across the descending node D of the Precessional movement, while in the p.m., or evening half of the globe there is a corresponding E.S.E en masse movement of the atmosphere as it moves parallel to K V L across the ascending node V of the precessional movement, and in all latitudes the wind will veer daily according as the local conditions are affected by this entire movement of the atmosphere, and according as this entire movement is encountered in the daily rotation. Thus if the wind be observed for one day from sunrise to sunset, and at sunrise it be approximately N.E,.then in the afternoon it will probably veer- to a position approximately S.E.,but the law of the shifting of the wind will be variable from sunrise to sunset, according to the position of the Sun and Moon, and according to the initial a.m. direction of the wind. I need scarcely say that the observed general law of wind is that it veers or backs every day with the motion of the Sun and Moon across the sky.

181.—The impact of the atmosphere L D K V of Figs. 1, 2, and 3, and context, or that is the Precessional resultant N D S V of the impact, if acting alone would make the obliquity of the ecliptic 90°, but the attraction of the Sun and Moon on the protuberant equator and tropics acts to remove the obliquity and to limit the action of the inclining or Precessional force, and the play of the two forces, the protuberance force and the precessional force, having their average resultants in two rectangular planes respectively viz. the solstitial E N W S and the Nodal N D S V the play of the two forces alternately prevailing produces the Nutation.

182.—The mean direction of the Precessional and Sec-

ular Retardation movement of the atmosphere is through the nodes D and V of the ecliptic and equator. Between the nodes by the passage of the atmosphere over the Earth in the tropics, that is, as the air passes from node to node round the Earth along the direction L D K V of the Precessional movement, the protuberant equator of the globe is recoiling by lateral friction from the atmospheric movement, this initially and at its origin determining the inclination, and now aiding to determine and maintain the obliquity, and the lateral recoil is largely responsible for and gives rise to the inclination of the lunar orbit to the terrestrial equator, and must ever prevent the coincidence of these two planes.

183.—From 182 and what has gone before, it may be clearly seen that the inclinations of the rotations of the various bodies of the solar system to their various orbits about their companions or primaries, are not determined by accident, but are the expressions of Precessional and Nutational forces acting through their atmospheres upon their oceans and solid globes, and thus giving rise to their inclinations. Hence the inclinations may be made to indicate whether the body possesses a solid globe or otherwise, and from this it will be found that the Sun is for the most part a solid globe, acted on by Precessional and Nutational forces, arising from the gravitation of Jupiter and the other planets.

184.—The inclination of the Sun to the path of the planets possesses a limiting angle, but the Sun is subject to Nutation, as shown by the periodical displacement of the Sun spots, as they transmit the disc.

185.—This displacement may be made to indicate the whereabouts of the intra mercurial planets,

186.—In Fig. 4, let K C L be the diameter of the Earth which produced along C L passes through the centre of the Moon given in conjunction at new Moon over L, then a plane containing P C A any diameter of the Earth rectangular to K C L is the plane of the Rational Horizon. Everywhere from the Rational Horizon in the day hemisphere there is a fall of air towards L by gravitation to the Sun and Moon, and everywhere from the Rational Horizon in the night hemisphere there is a movement of air towards K by the action of inertia of its particles resisting the fall towards L. Hence the air moves convergingly on to L and K from the Rational Horizon over the entire surface of the respective hemispheres under L and K, that is the air moves convergingly on to the centre or zenith of the day and night hemispheres. But

while the air moves about C L and C K in the manner given, or is subject to the force or forces which would so move it, it is deflected by the force P E and G F, the orbital force of 19—23, 54, Figs. 1, 2 and context, acting in a direction tangential or i.e. rectangular to C L and C K. The effect of the force directed to K and L is to convert the atmosphere into a prolate spheroid about the axis K C L and the effect of the force P E and G F is to deflect the ends of the prolate spheroid in the direction PE and GF by about 2 hours of arc, so that the resultant of all the forces under consideration is to convert the atmosphere into a prolate spheriod, with an axis about 30° from the axis K C L of Figs. 3 and 4 instead of about K C L, and thus is set up a barometrical maximum about 30° west of L in the day hemisphere, and another about 30° west of K in the night hemisphere, from which issue the trade winds, anti-trades, and the circulation of the atmosphere generally as it affects the base of the atmosphere, as shown in Figs. 3 and 4.
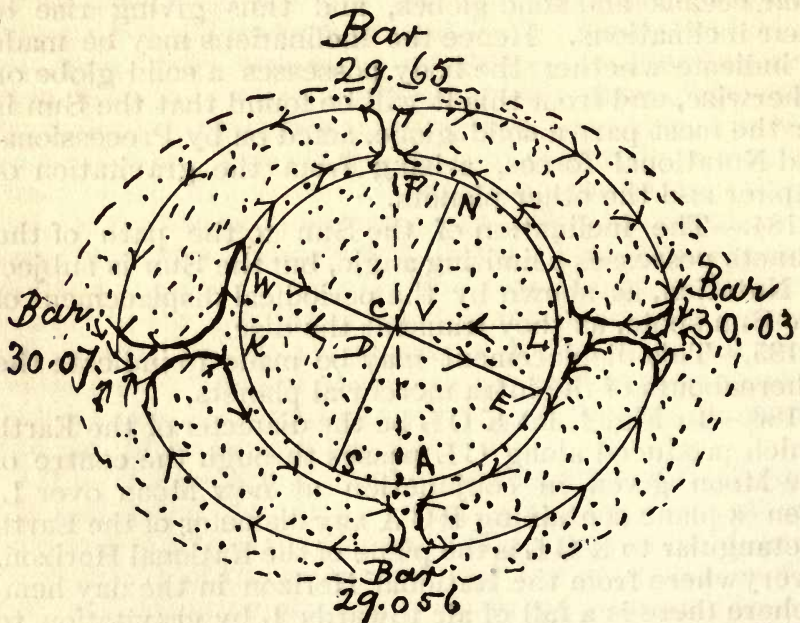
FIG. 4.
Circulation of the Atmosphere.

187.—The ecliptic meridian circle P L A K as deflected by orbital force is the great circle of high barometer, and low tide of the ocean, from which issue the winds and the waters, thereby giving rise to low tide along these circles, and P C A nearly coinciding with the Rational

Horizon or rotated therefrom through east to west about 30° is the great circle of low barometer towards which the winds blow over the surface of the Earth at the base of the atmosphere carrying the ocean waters with them into this circle, and so this circle is the circle of high-tide of the ocean, in so far as high tide may be associated with a great circle of the Earth. The circles P L A K and P C A follow the motions of the Moon rather than those of the Sun, so that the lunar Rational Horizon is the circle of high tide of the ocean, rather than the solar rational horizon, and only coinciding with the latter at the conjunctions, and always deflected over the Earth to the westward by about 2 to 3 hours of arc by the force P G; G F, the deflection being greatest at the conjunctions and its variation producing the diurnal inequality of the tides. The action of the Moon outweighs that of the Sun and is at all times similar to the illustrations just given, but at the quadratures and intermediate positions the effects stand related to a resultant of the Sun and Moon obtained by drawing the parallelogram of their forces, and regarding the two bodies as a single orb placed at the end of the diagonal or diagonal produced. When applied to the tides the position and velocity of this diagonal in arc determines the position and hour of the tides. The general figure of the atmospheric circulation for the conjunction of both New and Full Moon, and at all times to a large extent is that of Fig. 4, and regarding P C A as the rational horizon of the combined orbs or their resultant. This circle is a circle of doldrums as it were, comparable more or less with the doldrums of the equator, so that the observer carried through this circle in the daily rotation may expect comparative calm at the hour of transit.

188.—The atmospheric circulation is a fall of the air by gravitation convergingly to the position occupied by the Moon or the position of the resultant of the Sun and Moon, in the hemisphere occupied by these bodies, and a movement of the air as the result of inertia convergingly on to the nadir to these bodies in the opposite hemispheres, modified by a movement of the air in the direction of the impact producing the Precession of the Equinoxes and Secular Retardation, the air moving en masse in the ecliptic plane or plane of the lunar orbit on to the descending and ascending nodes or that is with a resultant cutting the Equator at the nodes, hence the atmosphere is simultaneously moving over the Earth from the poles of the Precessional movement on to the planes of

the orbits of the Moon and Sun or joint resultant plane, with return currents to the Precessional poles to supply the place of the air removed, and also in a direction that of the Precessional rotation L D K V of Fig. 2. That is, as illustrated by Figs. 2 and 4 the air is moving from the poles P and A into the circle L D K V in its upper limits, and returning from the circle L D K V to the poles P and A in its lower limits, and at the same time revolving *en masse* round the axis P C A in the direction L D K V over the rotating Earth, and opposed to the latter in respect to one resultant, and producing the Precession of the Equinoxes in respect to the other, and the Oceanic Tides are due to the action and reaction of these atmospheric movements acting on its waters as these are carried round by the rotating Earth in the diurnal rotation.

189.—With the Sun and Moon at L in Fig. 2 as the air converges on to L by gravitation to these bodies radially from the great circle P D A V, and by the orbital force L D K V is swept round from ecliptic east to ecliptic west over the whole hemisphere in one broad sheet of air movement, the entire hemisphere of air is directed into the arc L D and with a force greatest in the ecliptic plane, the plane L D K V, and this movement of the atmosphere produces a barometrical maximum the greatest on the Earth in the arc L D and directly over the low tide of the ocean cradle, which is in the arc L D, and from the arc L D the atmospheric currents move to form the trade winds and anti-trades, but the movement is masked by the rotation of the Earth, and diffuses itself over the tropics as a result of the rotation, as given in the former part of this treatise.

190.—Again as the air is swept along the arc V L D by the force V L D , the force being greatest at the point L directly under the tidal force of the Moon and Sun, it is abstracted by this force from the arc V L, that is from the region of high tide of the ocean, and in the arc V L there results a barometrical minimum as compared with the barometrical maximum in L D.

191.—Hence from the effects 188-190 there arises the diurnal oscillation of the barometer as the result of Tidal, Precessional, and Secular Retardation forces, and not as the result of thermal forces, to which heretofore the oscillation has been attributed.

192.—Again the forces of the air movement in the hemisphere P K A directed on to K. and through K the nadir to the Moon and Sun and from the arc P D A V being similar to those of the hemisphere P L A viz. a con-

vergence of air on to K and a Precessional and Secular Retardation rush through K in the direction D K V, these forces produce a barometrical minimum in the arc of high tide of the ocean D K, and a barometrical maximum in the arc of low tide of the ocean K V, similar to those of the opposite arcs.

193.—The continent of America interposed in the Precessional impact of air L D K V and parallels Fig. 2 prevents the ocean waters from passing from east to west across the space occupied by these continents,hence when these continents are passing under the Moon, the waves are forced from the leeward side of the continents into the basin of the Pacific, withdrawing water from the western shores of the continent, this action being greatest as the shores transit the circle P L A K, and greatest of all at the points K and L in respect to the force L D K V, but as the ocean tides may be regarded as a recoil of the waters from the impact, the greatest force of impact occurs when the greatest force of LDKV is in the equator, that is when the Moon and Sun are in conjunction in the equator, and this position will mark an establishment of the tides and atmospheric circulation both of which are largely polarised by continental reflection and other causes.

194.—The polarisation of the oceanic tides is such as to make the force L D K V, as a descending force in respect to the portion L D K, pass down the Pacific Ocean, while as an ascending force K V L it passes up the Atlantic. Thus as a result of polarisation of the oscillation we may say that there is a descending tide and an ascending tide, a descending tide in the Pacific Ocean which passes down the east coast of the old world and along its southern shores, and an ascending tide in the Atlantic which passes up the shores of both the old and the new worlds.

195.—The high tide of the ocean on the east coast and southern coasts of the old world is partly produced by direct action of the Precessional and Secular Retardation impact pushing the waters before it and producing a forced tidal wave, the tides in the Atlantic are an offshoot or lateral development of this, while on the contrary the tides on the western coasts of the American continents are due to reaction of the waters as the force L D K V is withdrawn by the rotation of the Earth carrying the continents into quadrature with the luminary.

196,—Thus the tides in the region of the old world external to the Atlantic are due largely to direct action of

the force L D K V, while the tides of the Atlantic are due largely to secondary action to the force L D K V, the force P E, G F of Fig. 1, and the tides of the western shores of the American continents are due to reaction of the waters as the force L D K V or that is P E, G F is withdrawn by the continents passing into quadrature with the luminary that is into the positions B and K of Fig. 1 in the diurnal rotation.

197.—The tidal oscillation is not reversed except by land deflection and polarisation as described, and we may consider the Earth as covered by two oceanic tides, a tide of direct action and a tide of reaction, or to some extent by many oceanic tides, according as the distribution of land and water breaks the ocean and seas into many basins, each of which has its own effects.

198.—The fundamental outstanding controlling view to take of the tides is that they are caused by the endeavour of the air and ocean particles to pursue elliptic paths about the Moon and Sun, in accordance with their distances from the luminary, an endeavour to obey Kepler's three laws of planetary motion in respect to the attraction of the Moon and Sun, and this view accepted then the effects can be traced and numerical analysis can be applied to determine the sequence of action.

199.—Precession of the Equinoxes and Nutation can determine all the kinetic and dynamic quantities involved in and resulting from the tidal forces.

200.—The Equilibrium Tidal Theory would express all the facts did the Ocean Tides result from direct action of the Moon and Sun upon the waters, and the fact that the Equilibrium Tidal Theory does not hold, but is about as far from the actual state of the case as it could possibly be, this fact alone indicates that the Ocean Tides are not produced by direct action upon the waters, and the only other view open is that they are secondary to the atmospheric movements.

201.—Especially would the Equilibrium Theory express all the facts were the oceanic tides due only to tidal compress.

202.—Were the oceanic tides due to tidal compress whether direct or reversed the tidal phases would be at the conjunctions and quadratures instead of in the intermediate octants, and because the phases are generated in these octants it is clear that the oceanic tides are not due to the action of the Moon and Sun directly upon the waters.

203.—It appears to the writer, that for all practical

purposes except in so far as acted upon by movements of the atmosphere, in respect to tidal action, the ocean must act as though it were part of the solid Earth, and be incapable in respect of that action of either rising into or becoming a tidal crest, or falling into, or becoming a tidal trough. In order that the tides may prevail, since water is practically an incompressible fluid, there must be actual translation of the waters in order to produce the tidal oscillation, and such translation forms part of the Precessional and Secular Retardation impact. For this kinetic movement the atmosphere acting upon the waters, being highly elastic and compressible and free to move, is eminently adapted to force the wave, and make the ocean tides.

204.—Yet if the reader chose to regard the tides as due to direct action of the Moon and Sun upon the waters, they are still due to the forces under consideration, the force P E, G F illustrated in Fig. 1, the force L D K V of Fig. 2, the Precessional and Secular Retardation forces, bringing the fluids into conflict with the solid globe.

205.—But since the range of barometrical pressures is equal to the displacement of the ocean bed by the tides, surely it is not irrational to suppose that the latter are related to the former. The atmospheric fluctuations can range over 4 inches of barometer, and this itself is equal to an oscillation of the ocean over about 4 feet of level. And clearly the changes of barometrical pressure can never represent the whole force acting on the atmosphere, because even while the atmosphere is piling above under the Precessional and Secular Retardation force, it is descending upon and flowing away at the base, and the kinetic energy of the winds under the orbital force of 19—23, 24, 54, Figs. 1, 2 and context, must exceed the barometric expression or potential. Under these forces the winds are subject to directive action dependent upon lunar-solar time, and under this directive action the energy of movement of the atmosphere over its entire depths and over the ocean waters is quite sufficient to account for the tidal oscillations of the oceans, and quite sufficient to act as the Precessional and Secular Retardation impact.

206.—If we consider the ocean waters as in excess in the high tide octants immediately in advance of the Moon and anti-moon they can only be there as the result of an atmospheric pressure of the two atmospheric tidal crests or barometrical maximums; and kinetic move-

ments of the winds going out from these two regions of high barometer.

207.—In 205 and context we have indicated that the kinetics of the atmosphere and changes of barometric pressure, the movements of the two barometrical maximums over the ocean in the diurnal rotation and the outgoing winds, and the kinetic movement of the atmosphere from east to west to produce the Precession and Secular Retardation, that the kinetics and pressures of these movements are quite equal to the kinetics and changes of level of the ocean, and are in force and energy more than sufficient to produce the latter and to give rise to the oceanic tides and currents. And in the various sections or arguments we have credited the atmospheric movements with sufficient force to produce that movement of the solid Earth which rotates or deflects it so as to give rise to the Precession of the Equinoxes and retard the diurnal rotation and produce the Secular Retardation.

208.—Clearly there is no direct action of the Moon upon the waters of the ocean which can throw these waters into a protuberance in advance of the Moon's position, without such throwing force accelerating the Earth's rotation. The force which advances the waters from west to east must necessarily be a force accelerating the Earth's rotation. No such force exists, on the contrary the tidal forces are the forces which are producing the Secular Retardation of the Earth's rotation, and therefore, are forces which act from east to west, in short are the forces of Figs 1 and 2. Consequently if it be admitted that there is a tidal protuberance of the ocean in advance of the Moon, say on the meridian two hours after the Moon culminates, then this protuberance is not produced directly by the tidal forces, which forces act from ecliptic east to ecliptic west to produce the Precession and Secular Retardation. Therefore on this view of the position of the oceanic protuberance, necessarily the oceanic tides are secondary to the atmospheric movements, and the kinetics of the latter in the Precessional and Secular Retardation and producing the latter outweigh those of any direct action of tidal forces of the Moon and Sun upon the waters.

209.—In so far as the Secular Retardation is due to the weight of a stationary tidal wave or oceanic protuberance resting upon and acting as a brake upon the rotating Earth, and to which action the Secular Retardation has heretofore been assigned, even if such a sta-

tionary protuberance exist, it can have no appreciable effect to produce the Secular Retardation; while in no case can the vertical pressure or weight of such wave produce the Precession of the equinoxes which is due to a force tangential to the Earth's radii, and is a rotation of the Earth in a meridional plane rectangular to that of the diurnal rotation, and involves an impact or force with a tangential resultant in the direction of this rotation.

210.—But let us consider what is the exact character of the oceanic tides.

211.—The oceanic tides are not a great swelling of the ocean always existent over two quadrants of the globe and forming the ends of a prolate spheroid, with a corresponding depression of the waters over the other quadrants or equator of the oblongated spheroid, but may be defined as a series of elevations and depressions or tidal waves which have had a common origin in a given region of the globe. So that when the whole ocean is considered, there is scarcely any protuberance except local protuberances of small area, and though the Moon and Sun or the direction of their tidal force are varying in declination over more than 50° of meridional arc of the Earth, the oceanic tides however much they may vary in height, appear to originate always in the same part of the ocean, and for the most part to pursue a common course over the globe, appearing to have their origin in the Pacific Ocean near the Galapagos Islands, and from there proceeding to all the shores of the ocean, arriving successively on these shores, at times of arrival depending upon the distance of the shores from the Galapagos and the course pursued by the tidal waves over the globe after they leave the region of the Galapagos Islands.

212.—In point of fact the ocean tides in their origin are polarised on a single rectilineal axis or direction, as a rectilineal oscillation, and have their origin about the one end of a single diameter of the Earth emergent on the equator in the Pacific Ocean in west longitude 90°, this diameter of the Earth being the axis of the oscillation, and the region of the Galapagos being that in which the oceanic tides originate, the cradle of the movement from which they are propagated in sequence to all parts of the ocean, and this region is the only source of the oceanic tides, and twice in each lunar day at intervals of twelve lunar or tidal hours, there is an oceanic tide produced on the ocean in this region of the Galapagos, from which it disperses to the ocean shores of all parts of the world. On the ends of the Galapagos diameter and in the

neighbourhood of the Galapagos twice in each tidal day the waters of the ocean are elevated into a protuberance comparatively local in character and of short duration in time in crest phase, and twice in each tidal day the waters sink into a corresponding tidal trough or depression, and this oscillation of level of the ocean at the Galapagos constitutes the tides in their origin, and is propagated from the region of the Galapagos in tidal waves which spread over the entire ocean, the tidal wave of each oscillation taking more than a tidal day to reach the furthest shores, and ere it has reached the furthest shores is succeeded by the tidal wave of another oscillation, that of a succeeding tide, and by those of other succeeding tides, all originated in the Galapagos region, so that there are at all times in the ocean several tidal waves, crests and troughs, but all of which for the whole globe have originated at the Galapagos and each been produced separately and successively by the single polarised oscillation of this region of the ocean, an oscillation which as already indicated may be termed a rectilineal oscillation of the ocean waters polarised on the Galapagos diameter of the Earth.

213.—Thus if we take into consideration all the tidal waves simultaneously existing on the ocean, the form of the ocean may be regarded as that of a symetrical sphere, or taking account of the Earth's rotation, that of an oblate spheroid bulging at the Equator, ruffled by tidal ridges and troughs which have come from the Galapagos region by wave motion or propagation, so that apart from the bulging equator of the oblate spheroid, the ocean cannot be regarded as protuberant anywhere unless at the Galapagos in proportion as the tidal oscillation of that region is in crest phase, neither can it be regarded as depressed anywhere unless at the Galapagos in proportion as the tidal oscillation of that the tidal cradle is in trough phase, neither can the ocean be regarded as a prolate spheroid whose ends are two tidal crests, and whose equator is two tidal troughs, such as the Equilibrium Theory of the Tides supposes, and such as the theory of direct action of tidal force upon the waters exerted radially would require.

214.—On the Galapagos the ocean is protuberant about 2 hours after the culmination of the Moon on the meridian of that region, and depressed about 8 hours after the culmination of the Moon, and this Galapagos oscillation originates all the tidal waves of the ocean over its entire area, passing in sequence from the Galapagos

from east to west round the entire globe and entering the Atlantic from both east and west, passing up the Atlantic all the way to the Polar Regions, the tide which reaches the latter having originated in the Galapagos about two tidal days before arriving near the Pole.

215.—From the Galapagos, the tidal waves resulting from the Galapagos oscillation, move up the western coast of North America and down the western coast of South America entering the Atlantic near the terminal cape of that continent ; on the other hand, the tidal radiation from the Galapagos centre can be traced as a tidal wave moving from east to west across the Pacific Ocean, and, striking the Old World, can be traced down its eastern and along its southern coasts, and still careering westwards (entering the Bay of Bengal and Arabian Sea in passing) through the Indian Ocean, can be traced past the Cape of Good Hope, and turning into the Atlantic, is found moving all the way to the North Polar Regions. Thus from the Galapagos there is an East going and a West going Tidal wave, and these waves meet and superpose at the southern entrance to the Atlantic, thus modifying the flow of the tides up the Atlantic, but all this flow has originated at the Galapagos as the centre of radiation.

216.—The flow of the Tidal waves from the Galapagos resembles that of a sound or light radiation, whose vibration is transverse, and whose wave length is about 96° of arc of the Earth, say in round numbers 6600 miles from trough to trough or crest to crest, and there are troughs and crests, at this distance on the average all along the tidal course, following each other for every conjunction and opposition of the Pacific Ocean and the Old World land protuberance with the tide producing orb or orbs, the Moon or the resultant of the Moon and Sun combining their forces.

217.—All the crests and troughs of the series of Tidal waves which cover the ocean in its entirety, of which at any moment there are not less than six of each phase moving over the globe, are replicas of the crests and troughs of the ocean waters which occur alternately-consecutively in the Galapagos, and have originated in this centre, two of each phase in a Tidal day and have been received by transmission or radiation from this centre, regarded as the source and centre of radiation for all the tides of the ocean.

218.—The rising of the oceanic waters or wave crest of the Galapagos is radiated outwards in all directions,

the radiation producing the flooding of the contiguous American shores by the eastward and meridional directions of movement ; and of every shore in succession for all parts of the world by the constant moving of the crest across the Pacific, the time of rising at successive shores being determined by the distance from the Galapagos centre of radiation, and velocity of wave propagation. The sinking of the oceanic waters or wave trough of the Galapagos is similarly propagated in succession to all parts of the ocean.

219.—If the ocean was everywhere of uniform depth the wave crests and troughs would travel as circular waves moving out radially from the Galapagos, but variable depths and land deflections produce reflections and refractions of the directions taken, but all of which can be easily traced ; and the directions taken by the tidal waves as they proceed from the Galapagos; with the variations of velocity, are a measure of the ocean depths such, that a cotidal chart gauges the depth of the ocean with an accuracy proportionate to that of the chart. A correct cotidal chart is as it were a pantographic representation of the ocean bed and ocean depths.

220.—As the crest of waters at the Galapagos falls in phase, the phase is radiated away along the course of the tidal wave, striking the western shores of America first. As the trough of waters at the Galapagos fills up, the phase is radiated away along the directions taken by the Tidal wave, striking the western shores of America first. But even while moving eastward and meridionally on to America, crest and trough career also in every other radial direction, and westward across the Atlantic as the chief direction of the Tidal wave.

221.—To trace the path of phase of the Tidal wave from the Galapagos, fetch a compass round the Galapagos over the globe, and if the proper time interval be taken the phase originated in the Galapagos will be on this circle, except that allowance must be made for reflection and refraction by depth and contour of the ocean bed, but the radial view under consideration is the true view of the tides.

222.—A single glance at a map or a terrestrial globe will show that the atmosphere and ocean; the air and waters, in respect to east and west are both in mass eccentrically situated upon the side of the Earth occupied by the Pacific basin, both air and water being displaced from the opposite side of the globe by a great protuberance of land forming the Old World and stretching down over

Australia and the intervening and contiguous islands, or we may regard the land hemisphere as including the continents of both the Old and New Worlds. Hence the solid Earth and the enclosing fluids, those of the ocean and atmosphere form a pair or group whose centres of gravity do not coincide, being eccentrically situated in a diameter of the Earth emergent at the centre of the Pacific, and which is at quadrature or almost at quadrature with the Galapagos or tidal diameter, which latter forms the axis of the rectilineal polarised tidal oscillation (see 212). Hence, as the Earth makes the orbit through space round the Tidal Orb (the Moon, or Moon and Sun in combination) and rotates, when the centre of the Pacific and the Tidal Orb are in conjunction, that is, when the centres of gravity of the solid Earth and enclosing fluids are in conjunction with the Tidal Orb, then the ocean and atmosphere are moved en-masse with a force urging them in the orbit with greater velocity than the orbital velocity produced upon the solid Earth, which latter lies more remote from the Tidal Orb than the enclosing fluid-sphere; on the other hand, when the centre of the Earth, Pacific, and Tidal Orb are in opposition, then the fluid-sphere about the Earth is moved with a force urging it in the orbit with a velocity less than that conferred upon the solid Earth, hence necessarily ensues a tangential oscillation of the solid Earth and the enclosing fluid-sphere in the orbit, a to-and-fro motion of each in a tidal day, in which the momentums of the solid Earth and enclosing fluids are equal each to each but in opposite directions and are varying with a reversal and a zero point, occurring at the quadratures twice in a Tidal day. This oscillation of the fluid-sphere affects the ocean on the Pacific side of the globe, and affects the solid Earth on the landward side of the globe. Hence necessarily there is an oscillation of the solid Earth and the enclosing fluid sphere, and one in which the matter of the water and air at every conjunction and opposition of the centre of the solid Earth, the Pacific and Tidal Orb, is deflected round the Earth in a direction from east to west, acting to produce the Atmospheric and Oceanic Circulation and the Secular Retardation.

223.—But the ocean waters and the enclosing atmosphere are themselves eccentrically situated on the Equatorial-Pacific diameter of the Earth, so that ocean and atmosphere may be regarded as alternately coming into conjunction, quadrature, opposition and quadrature, and

in this order, with the Tidal Orb. Hence in respect to this conjunction and opposition the ocean waters and air will oscillate on the Pacific in a tidal interval, or two oscillations in a lunar or Tidal day, in such a way that high tide of the air will tend to give low tide of the ocean, and vice versa, that is, give conditions which are observed conditions of the tides of the ocean and barometrical distribution of the air. See Figs. 7, 8, 9, 10.

224.—We have indicated what vast considerations the Oceanic Tides and Atmospheric Circulation involve, but these are reduced to comparative simplicity when the former are regarded as chiefly secondary to the latter.

225.—The forces which produce Precession of the Equinoxes, Secular Retardation, and the Atmospheric Circulation, are undoubtedly those which produce the Tides and Currents of the ocean, and it is equally certain that these forces are centripetal force of gravitation directed to the Moon and Sun acting on the tangential motions of the Earth and its fluids in their orbits through space about the tide producing orb, combined with centripetal force to the Earth and the Diurnal Rotation, the combined centripetal and tangential forces of the orbit giving rise to the force of 19—23, 54, Figs. 1 and 2 and context, and thus bringing into action to produce the tides, that which is effected by the diurnal rotation of the globe and centripetal force of terrestrial gravity. In short, the TIDAL FORCES ARE GRAVITATION TO THE MOON, SUN, AND EARTH, ACTING ON THE TANGENTIAL MOTIONS OF THE TERRESTRIAL ORBIT AND DIURNAL ROTATION, or that is, the Centripetal and Tangential forces acting mutually upon the solid Earth. and fluid air and ocean, and the only question open to discussion is the manner of their operations.

226.—In the matter of the tides, the Newtonian theory has assigned, and as far as the writer can learn, all other philosophers and writers dealing with the matter—Kepler perhaps excepted—have assigned the tides to the centripetal force of the Tidal Orb as the only force producing the tides, and that by acting directly upon and raising the waters of the ocean by a force directed radially to the Earth along the radius vector of the orbit. This is entirely or almost entirely an erroneous view, certainly more so than that of Prop. 66 Principia dealing with the motion of the apsides and which led Newton to an error such that "by omitting the consideration of the tangential force (as he often does in the Principia when dealing with force and motion) he calculated the amount at one

half its true value" an error since made manifest by the results of observation.

227.—All force is motion, and all motion is force, and there is no other force in the universe but motion.

228.—When two forces or motions or a motion and force act in rectangular or tangential directions only a portion of each appears in the diagonal of the parallelogram of force or motion, and this is true of every parallelogram resultant of two motions, two forces, or a force and motion, and is a truth of the utmost importance in dealing with orbital force and planetary motions.

229.—The tangential force of the Earth in the orbit has been and is ever being both conferred and destroyed by centripetal force to the companion or primary in a manner such that at the expiration of the time occupied by a quarter revolution in the orbit, the tangential motion or force acting at the beginning has been destroyed, and an equivalent amount in a rectangular direction been produced, but at any given moment the tangential motion may be regarded as a force acting independent of, and for circular orbits, acting rectangular to the centripetal force, but equally available to be drawn upon to produce the phenomena of the Atmospheric Circulation, Oceanic Tides, Precession of the Equinoxes, Secular Retardation and Nutation, as is that of the centripetal force.

230.—The Newtonian philosophy has treated the tangential force of a circular orbit, too much as a passive and constant quantity neither increasing nor decreasing, whereas as a matter of fact, as already indicated, the law of a moving planet in a circular orbit is such that at any moment the primary is removing and conferring orbital motion or force in two rectangular directions tangential and centripetal, that is, destroying force or motion at right angles to the radius vector and conferring force or motion along the radius vector respectively, an exertion of force by the primary double that assigned to the latter by the Principia, and the whole of which is required to deflect the motion of the planet in the orbit, and to sustain it at a constant velocity, the result of the motion lost and the motion gained by the planet being that the planet moves in the curved orbit. By centripetal force alone, and in the absence of tangential motion the planet would fall to the primary in $\frac{7}{11}$ of the time taken to complete a quarter revolution would fall $(\frac{11}{7})^2 = \frac{121}{49} R$, which gives double the force available to produce the tides to what is assigned by the Newtonian philosophy, and divided into two rectangular directions under con-

siderations of variation and perturbations on the rotating Earth and the fluids of the enclosing fluid-sphere which fully explain the tides, and also along with this, the Atmospheric Circulation, the Oceanic Circulation, and the other kindred effects.

231.—Breaking away from all preconceived notions or school boy views of the Tides as taught in the text books and as illustrated by egg-shaped, or prolate spheroid figures of the ocean, all of which are radically unsound in their treatment of the Tides, and breaking away from the Equilibruim Theory of the Tides as tentatively considered and held; we may say that these must go in their entirety. The theory of two oceanic tidal protuberances forming the ends of an ellipsoid or prolate spheroid of which the ends are two tidal crests with the ocean waters always piled on these ends, this must go in its entirety with respect to both form and kinetics. The theory of the simultaneous formation and existence of two oceanic tides or protuberances at opposite sides or opposite ends of a diameter of the Earth must go. The theory that there are two tides resting upon the Earth always and simultaneously making and always and simultaneously dispersing must go, unless as simultaneously affecting and producing the entire six tidal protuberances or crests of the globe along with the corresponding troughs which it appears to the writer is physically impossible.

232.—In their origin the Tides have a trough origin at the Galapagos alternating with a crest origin, and at intermediate phase there is no tidal protuberance upon the globe anywhere, in the sense of the prolate spheroid view, or of the view taken by the Equilibrium Theory of the Tides, or of any view which regards the Tides as due to radial elevation of the waters to form the originating crest, with an elevation in opposite hemispheres of the globe.

233.—Both tides of the Tidal day originate on the Equator immediately around the Galapagos, that is, on the Galapagos end of a diameter of the Earth emergent on the Equator in west longitude 90°, and from this point they are propagated to all parts of the world, originating in this region at a definite time, travelling from this region to all parts of the ocean at a definite speed, determined by the depth of the ocean bed and contour of the solid globe, along definite courses similarly determined, and in a manner such, that at any moment, there are six tidal troughs and six tidal crests of the ocean waters co-

existent upon the globe, which have originated at six successive alternations of trough and crest phase at the Galapagos; at six successive tidal intervals, each interval comprehending a trough and crest origination, at conjunctions and oppositions of the Pacific with the Tidal Orb, in respect to the troughs, and at quadratures of the Pacific with the Tidal Orb in respect to the crests. That is, when the Tidal Orb (the Moon or anti-moon, or Moon and Sun, or anti-moon and anti-sun combined) is in longitude 180° then it produces trough phase of the tides at Galapagos in longitude 90°, by withdrawing the waters of the Pacific from this region under the forces P E, G F of Figs. 1, 7, and 9. That is to say the forces which develope the trough phase of the tides are at this moment running strongest in the Pacific Oceanic Basin and at this moment the Precessional and Secular Retardation impact of the fluids of the air and ocean against the solid Earth, more especially against the eastern slopes of the Old World is running strongest. The actual trough phase at the Galapagos occurs about two hours after this at about 8 o'clock local-lunar-Galapagos-time when the resulting momentums of the waters from east to west has subsided and the waters commence to return from the eastern slopes of the Old World back to the western slopes of the New to produce crest phase of the Galapagos oscillation by the return of the waters, which return produces the crest phase of the tides at the Galapagos.

234.—Hence the whole question of the Tides of the Ocean resolves itself into that of the cause of the radial oscillation of the ocean waters at the Galapagos, the transverse oscillation of the Tidal wave in respect to its horizontal course in this region, that is, the polarised oscillation along a rectilineal axis of the Galapagos wave a diameter of the Earth emergent in west longitude 90°.

235.—From the position of the cradle or source of the tides at the Galapagos on the Equator, we must necessarily conclude that the Tidal force or its resultant is directed in the plane of the Equator, the plane of the Earth's rotation, that of the Secular Retardation force; and it is clear that they are due to the operation of this force and the Earth's rotation and terrestrial gravitation.

236.—We must not forget that the trade winds converge on the Equator and have their resultant in this plane, that in force they represent half the entire Circulation of the Atmosphere and in their resultant, as representing almost their entire force, are directed due

east to west, the other half of the Atmospheric Circulation being almost entirely promiscuously directed with almost as much westing as easting; and that by acting on the waves of the ocean which present to the winds a great vertical sail area, and also by acting on the slopes of the Tidal waves presented to their impact, that the trade winds contribute to the Secular Retardation as is manifested by their action piling up the ocean waters against the eastern shores of the world and producing the currents of these shores which flow polewards, at the same time withdrawing waters from the western shores of the world and producing currents which flow linewards along these shores. Hence any diurnal variation in the force of the trade winds, tidally speaking, that is with reference to the tidal day, if rhythmic to the tidal intervals, that is, with a flow and ebb or increase and decrease of east to west force; necessarily this variation of wind force must produce an alternate swing of the Pacific Ocean alternately from east to west and west to east, accompanied by a centrifugal force or rise of the water level, directed from the Earth's centre on the east to west or action swing; with a centripetal force or fall of the water level, directed towards the Earth's centre on the west to east or reaction return.

237.—Such a variation of the force of the trade winds does exist, but more statistics are required before attempting to demonstrate its existence in this treatise, but it is absolutely and physically certain and necessary that such a variation exist.

238.—The power of the winds to raise the level of the ocean shores and to raise a Tidal crest on the enhanced level, is manifested by the great increase in the height of our own local tides in Britain when strong westerly winds are blowing across the Atlantic on to our coasts, a rise of level which greatly affects even our eastern coasts, often producing on the river Tay a rise of several feet above the proper or normal tide level especially at spring tides.

239.—This rise of the tides by the action of the winds is due to the pressure of the wind on the slope of the tidal wave, towards which the wind is directed with a component of pressure translating the waters in this direction, steadily and slowly piling the waters up the incline, the wind pressure against the sail area of the tidal slope with the aid of viscosity preventing the return of the waters all the way to the lowest depths, and to the wind pressure against the wind produced waves tilted

towards the wind on the windward or rear slope of the tidal crest; and to the tidal wave moving over the heightened level of the waters, a level which would be increased by the westerly winds from the Atlantic, even if no tidal wave existed.

240.—It is well known that in the Mediteranean where tides are almost absent, a storm from the south-west can raise the waters on certain shores of its northern coast by about 5 feet.

241.—The power of the wind to remove water from a coast is equally pronounced. In some cases violent winds can produce a fall of the water in a harbour by several fathoms, even to the extent of stranding ships, which apart from the action of the wind usually ride safely in the harbour in all states of the tide.

242.—If then, comparatively local winds, can raise the waters of the ocean by several feet, what must be the power of the Trade winds moving briskly in the Tidal basin of the Pacific and pushing its waters over half the circumferance of the globe, and acting to raise the waters upon the eastern shores of the Old World? Our estimate of this power is 40 feet as the difference of level of the Pacific Ocean at the Galapagos as compared with that in the Phillipines, or at the Sunda Islands, the former region possessing the lowest level.

243.—This 40 feet of head is ever ready to return the waters in the direction of the Galapagos should the velocity and pressure of the Trade winds relax, and if by a semidiurnal variation of their force, in a Tidal interval, this head is varying its height however slightly, this will produce a movement of the Pacific waters alternately directed en-masse from west to east, with a momentum producing a compress of its waters at the Galapagos; which will raise a tidal wave having its crest in this region, and from east to west, with a momentum withdrawing waters from the Galapagos, which will produce a tidal trough having its lowest level in this region, crest and trough at the Galapagos synchronising with the semi-diurnal variation of Trade wind force, or that is, of its equatorial resultant. Whatever be the manner in which Secular Retardation force produces a head of water on the eastern coasts of the Old World, any variation of this force in a tidal interval affecting the height of the head, will produce a Tidal oscillation on the Galapagos and intermediate longitudes.

244.—Whatever view of the Tides or Tidal force we take, the rhythmic tangential sway of the waters of the

ocean, more particularly of the Pacific Ocean, round the equatorial circle of the globe alternately from east to west and west to east, complete to-and-fro oscillations in Tidal intervals, these tangential oscillations are the cause of the tides, and the TRUE TIDES, originating all the Tidal waves of the ocean which move over the globe vibrating in vertical planes in directions transverse to the surface, all of which Tidal waves or transverse oscillations are subsidiary and secondary to the true Tides the primary or the tangential oscillations of the ocean waters under consideration.

245.—The equatorial tangential oscillations of the waters of the Ocean the primary Tides must be regarded as the Tidal force; and chiefly by their momentum, will he determined the height of the tides on every shore in the world.

246.—Thus at any moment there is upon the globe tidal oscillations, (not a pair of crests separated by 180° degrees of a great circle of the Earth such as the prolate theory or radial tidal force theory requires), these tangential ones round the Equatorial circle of the Earth, with swings alternately from east to west and west to east, effected in either direction in a crest to trough interval, i.e. one complete oscillation in the interval of time elapsing between two successive tides, and tangential oscillations of the waters of the Ocean are the true Tides or Tidal force of the ocean, calling into existence and producing, all the crests and troughs of every tidal wave, and the ebb and flow of the tides on every shore.

247.—The tides of the ocean are undulations over its surface, which in respect to each tidal wave and embracing crest and trough phase, cover 96° of geographical arc, or that is a quarter of a lunar day of arc, while if pro duced in pairs at opposite ends of a diameter of the globe by tidal compress or centripetal forces of the waters and fluids of the Earth directed over the Earth to the line of conjunction and convergingly on to this line, they would be tidal crests or protuberances separated by 180° not 96° of geographical arc. The quadrantal position of the tidal waves, (as against 180° if produced in pairs) prove that they are not produced diametrically but quadrantly.

248.—Whether produced secondarily to the Trade winds and Atmospheric Circulation, or by direct action to the Tidal Orb and tangential force of the Earth and its fluids in the orbit acting and reacting along with the

Earth's rotation and terrestrial gravity, it appears clearly and with all certainty to the writer, that the oceanic tidal waves are produced by tangential sways of the ocean, more particularly of the Pacific Ocean alternately from east to west and west to east rhythmically in Tidal intervals and that these tangential swings of the ocean waters set up transverse undulations or radial vibrations which constitute the tidal waves the crests and troughs which cause the ebb and flow on every shore affected by tidal impact, and that these transverse movements are principally set up and originated on the Equator, at the Galapagos, in west longitude 90°, in crest phase at the Galapagos at the establishment of the tides at 8 o'clock Greenwich time, 2 o'clock Galapagos time, and in trough phase at the Galapagos at a quarter of a lunar or Tidal-day from this, that is at 8 o'clock Galapagos time, as given in 233, p. 79, and near Marshall's Islands in longitude 180°; the great Pacific-Galapagos—Marshall tangential swing being divided into two tidal undulations or tidal waves, each of 90° of arc as embracing crest and trough phase, which tidal waves both in their generation and progress are following the Moon round the world in her daily course, and synchronating also with her monthly progress, and though the amplitude of the tidal waves greatly respects the position of the Galapagos and Marshall's Islands, there is phase production of increase or decrease at every stage of their progress round and over the world.

249.—We have thus reached the conclusion, a conclusion of the utmost importance, viz., that the Tidal force is in its immediate operation, a tangential force, tangential to the Earth's circle ; in contradistinction to all previous views which have assigned the tides to a radial force or resultant raising or converging the waters by direct action on to the radius of the Earth's orbit about the Tidal Orb.

250.—We assert that waters of the ocean converge or flow into the plane of the Ecliptic, in company with air, we assert that waters of the ocean converge or flow into the Equator in company with air of the Trade Winds, and this is a force which may play a part in the production of the oceanic tides as it does in the oceanic circulation as already set forth in this treatise, but all this said, we conclude that the oscillations of the waters giving rise to the Tidal wave or waves are forces acting tangentially round the Earth with their resultant directed in the plane of the Equator, a resultant acting alternately from east

to west and west to east in the manner given.

251.—If we assign the tidal troughs to the forces P E, G F of Fig. 1, i.e. to orbital force, then the crest phase of the tides is due to reaction from this force as the ocean waters of the Pacific or Tidal basin pass from conjunction or opposition and come into quadrature with the Tidal Orb in the diurnal rotation and the force P E or G F ceases to act on the fluids the air and water of the Tidal basin, and terrestrial gravity, acting on the displaced waters, wholly or partially returns these to their normal level, thereby producing a compress and elevation of the waters on the western shores of America near the Galapagos. When the Moon is directly over the Pacific in longitude 180° in a position 90° west of the Galapagos, this is conjunction of the Tidal basin, the Moon is then on the horizon and setting at the Galapagos, and the tidal ebb running strongest there, by withdrawal of the ocean waters from that region. A quarter of a lunar or tidal day later the waters return upon the Galapagos by terrestrial gravitation, and the tidal flow is now running strongest in that region. Similarly if we follow the Tidal basin round to the other side of the Earth to the position of opposition with the Tidal Orb, all as illustrated in Figs. 7, 8, 9, 10, we have similar consequences.

252.—The Galapagos is alternately the rear and front end of a Pacific swing at trough and crest phase respectively. This swing is a swing of the ocean waters affecting 90° or 180° of the Pacific according to whether we view the swing of the waters as one of 180° or subdivided into two of 90°. It is really the latter, so that we may say that the Galapagos tidal wave, as of all other tidal waves, is due mainly to the operation of a quadrantal force where direction alternates at intervals of a quarter of a lunar or tidal day.

253.—In movements of water in a basin, and in tidal effects, the sides of the basin and ends of the movement always give the most powerful undulating or vibratory results.

254.—The tidal force producing the Galapagos trough is that of the Secular Retardation impact moving the air and waters of the Paciffc bodily towards the shores of the Old World and piling the waters up in this direction, while the tidal force producing the Galapagos crest is that of terrestrial gravity returning the piled air and waters to their normal level beyond which they rise as the result of their returning momentum.

255.—Thus if we assign the tidal troughs of the ocean as produced at the Galapagos and propagated from there to all parts of the world, to centripetal force of the fluids of the air and water to the Tidal Orb, then we must assign the tidal crests to centripetal force of these to the Earth's centre, and according to which of these forces is prevailing in the Tidal basin, the waters at the Galapagos are falling or rising. Thus centripetal force to the Tidal Orb and tangential force in the orbit of the Earth about the latter produce the tidal trough, centripetal force and tangential force about the Earth called into action by the diurnal rotation produce the tidal crests, and the alternate prevailing of these two sets or pairs of forces, produce the great Tidal - Basin - Tangential - Oscillations, and variation of level with respect to east and west and west to east, the oscillations and variations which are the true or primary tides giving rise to all other tidal movements of the ocean as these proceed from the various cradles of their movement, the regions passing under the quadrantal forces, more especially from the neighbourhood of the Galapagos and Marshall's Islands.

256.—The tides proper, in their generation, are oscillations of the ocean in or about the Equator from East to west and from west to east, which raise tidal waves which follow the rising and setting of the Moon and her course round the globe, and not a pair of prolate spheroidal protuberances as the theories heretofore advanced have supposed.

257.—The fact that the Atlantic, though it shows Secular-Retardation piling of its waters against the American slopes with corresponding currents flowing polewards along these shores, does not show any apparent tangential tidal oscillation, and no tide of its own generation, or one entirely outweighed by that of the Pacific, this suggests that the Atlantic swings with the solid Earth as though it were part of the latter, and in the opposite direction in space to the swing of the Pacific Ocean. The solid globe and the Atlantic together form a mass whose swing, though in momentum equal to that of the Pacific, to that of the waters of the Tidal basin, to that of the 180° Tide, is through an arc relatively as small as that of the Pacific mass of fluids is to the mass of the solid Earth, or Earth and Atlantic combined. Hence if the Atlantic oscillates with the continental or landward protuberance of the globe, that is, with the solid Earth in the tidal swing, it can have no appreciable tangential swing, and thus no appreciable tidal generation, and so

there will be no tide originated in the Atlantic basin, and no tides, except the tidal waves received from the Pacific in respect to the 180° tidal swing.

258.—The passivity of the Atlantic in the matter of tide production, and receiving all its tidal waves from the Pacific, indicates that the tidal waves are produced by the swings of the Pacific fluids and not those of the Atlantic.

259.—In the tidal swing, that of the primary tide, we place the solid globe and the Atlantic fluids on one side and call their momentum M, ou the other side we place the Pacific fluids, the air and water of the Tidal basin, and call their momentum M*I*, then at all times M = M*I*, these momentums are at all times oppositely directed, and each act alternately from east to west and west to east. While the momentums are equal the velocities are very unequal, the velocity of M is inappreciable, while that of M*I* is an east to west rush of all the fluids of the Tidal basin aiding to produce the Secular Retardation and the chief factor of the latter.

260.—In the tidal swing, the solid globe and Atlantic move together through an unappreciable arc, the Pacific waters alone acquire a velocity sufficient for tidal generation.

261.—We must reiterate. In the principle tide, the mass on the one side is the entire globe only excepting the fluids of the one hemisphere in what may be termed the Pacific or Tidal basin, the mass on the other side are the fluids of the Tidal basin, and the tidal oscillation is called into existence by the rotation of the globe causing the Tidal Orb to alternately quicken and slowing the fluids of the Tidal basin in the orbit about the Tidal Orb, quickening their movement in the orbit at the conjunctions, Fig. 7, slowing their movement at the oppositions Fig. 9, by the forces P E, G F of Fig. 1 respectively, acting on the fluids of the Tidal or Pacific basin, and the solid Earth though quickened and slowed by equal amount in momentum at opposition and conjunction with the Tidal basin and Tidal Orb, may be regarded as moving through space without change of velocity in the Tidal swing, though to be absolutely correct there is a slight semi-diurnal change of velocity in the orbit at the different tidal hours of the principle tide even for the solid Earth, but the change of velocity is always in opposite directions to that of the fluids of the Pacific basin, the combined effects giving rise to the principle Tidal swing or primary tide.

262.—There have been so many hazy views regarding the tides and in so many quarters, that we must continue to reiterate in order to make our own views and conceptions quite clear to the reader. Could the observer see the movements of the primary tide, he would discover that at every point of the oscillation the movement of the water is directed round the Earth horizontally at each point of observation, so that it may be regarded as a horizontal movement of the waters and not a vertical evcept in so far as the horizontal movement checked and reversed in its course calls up the latter. The horizontal movement of the water is making impact against the slopes of the solid Earth, and against its own unmoved mass and inertia which have not taken up the movement, an impact alternately from east to west producing Secular Retardation, and a recoil from this directed from west to east producing the impact against the western slopes of America which at the Galapagos developes a tidal wave, the latter a transverse or radial movement, thus the tidal wave is developed by recoil of the fluids from the Secular Retardation impact. That is, the tidal wave regarded as produced at the Galapagos, as the cradle of its origin is developed by recoil or reaction of the fluids of the Tidal basin, but later on in connection with Figs. and context, we shall show that east to west impact aids the tidal crest of longitude 186° W. where the tides synchronate alike in phase with those of the Galapagos.

263.—The fluids move over the Pacific basin piling the waters against the Old World, producing Secular Retardation, a movement greater on the fluids of the atmosphere which have extension and mobility, bnt a movement affecting directly and kinetically all those waters of the Pacific which are protuberant or external to a tangent to the circle of the ocean bed, and by contact and viscosity; affecting the waters to their entire depths, thus piling up the waters against the Old World, but the return of the waters from west to east under terrestrial gravitation, when the Secular Retardation force is withdrawn at the quadratures, is a movement of momentum and pressure directed in greater force along the bottom of the ocean, so that the waters well up at the Galapagos in a movement directed radially.

264.—Thus the tangential oscillation of the Pacific Ocean is accompanied by vertical movements of the ocean waters in which the water is descending on the eastern shores of the Old World, and ascending on the

western shores of the New World with a variable force at different tidal hours, so that the ocean at the Galapagos alternately rises and falls in a tidal interval developing a tidal wave which passes over the ocean to all parts of the world. The movement of the Pacific waters strongest along the bottom directed from west to east, developes a compress an impact and a fountain or lifting force at the Galapagos of sufficient momentum and force to raise the tidal wave, which marks a never ceasing effort of the waters to find their level as a position of rest. At the conjunctions of the tidal wave, the waters are thrown into horizontal movement from east to west, and from the eastern coasts flow away polewards, at the quadratures they return with an impact focussing on the American slopes dipping into the Pacific around the Galapagos, these slopes as they are elevated to form the American continents, damming back the return of the waters and preventing their flow into the Atlantic, thus raising the crest of the tidal wave, and by means of which the effects are shared by the whole ocean.

265.—The momentum of the west to east Galapagos impact of the fluids the air and water of the Tidal basin is to be measured by the energy of the resulting tidal waves, an energy developing thermal motion and radiation; and dissipating a reaction equal to the tidal return of that force whose action is measured by Precession and Secular Retardation, in an equation in which action and reaction are equal.

266.—Thus the oceanic tides are in the main and regarded as dispersing their own energy, due to the reaction of the ocean waters from the Secular Retardation impact, a reaction brought into play by the Earth's rotation and opposed by the continental dams, that of the landward protuberance of the globe, but which dam also opposes the action which produces the Secular Retardation.

267.—If we regard the Pacific Ocean in respect to the fluids of the Tidal basin as these move in the action and reaction of Secular Retardation, and call the action a force, action in relation to the conjunctions and oppositions of the Tidal basin with the Tidal Orb, reaction in relation to the quadratures of the Tidal basin with the Tidal Orb, then these forces synchroniously and simultaneously raise a tidal crest on the Equator at the Galapagos in longitude W. 90° and a similar crest in longitude W. 180, that is two tidal crests at quadrantal positions to each other in the same hemisphere, and as the Earth ro-

tates in the diurnal rotation while these crests are sustained in the Tidal basin by the forces of action and reaction they move from east to west across the Pacific that is across the Tidal basin, and were we to assign Secular Retardation to a tidal brake, which we do not in the ordinary sense of the term, these are the crests whose pressure would exert the tidal brake. We assign both Precession and Secular Retardation to actual impact of the fluids of the Earth, especially those of the Tidal basin as these fluids are moved across the Earth by the forces P E, G F of Fig. 1, acting on the fluids of the air and ocean, modified by the Earth's rotation ; we assign Nutation to these forces modified by gravitation of the Sun and Moon upon a protuberant equator of the Earth, (a force which acting alone on the rotating Earth would speedily remove the obliquity as its only action) and we assign the Tides to these forces modified by the eccentric positionof the Ocean. If the water and land were in balanced symmetrical proportion all round the globe, or even approximately so with respect to longitude, the oceanic tides would largely if not entirely cease to exist, but the Atmospheric Circulation (especially that producing the semi-diurnal barometrical maximums and minimums and the trade-winds and anti-trades) Precession of the Equinoxes, Secular Retardation, and Nutation would still go on, but under greatly modified and less accentuated conditions.

268.—*Referring now to* Figs. 7, 8, 9, *and* 10, *we reach the startling generalization that the Oceanic Tides are due in the main to the eccentric position of the fluids of the globe, that is of the air and water referred to the centre of gravity of their entire mass, which is eccentrically situated upon the side of the globe occupied by the Pacific Ocean.*

269.—Referring to Figs. 7, 8, 9 and 10, P E, G F, may be regarded as the forces P E, G F, of Fig. 1, p. 44,which were shown to have a tangential component along P D, and LF, i.e. round the Earth from ecliptic east to ecliptic west, and a vertical component along C E and C G respectively. To the two rectangular components of the former we assign Precession and Secular Retardation respectively, to the latter we assign the vertical oscillations of the Oceanic Tides, those transverse to the surface, as giving the energies which produce the effects.

270.—Referring to Fig. 1, p. 44, and regarding the crescent shaped segments K E H D and B G K L respectively, as the Pacific Ocean or waters of the Tidal Basin at two positions a semi-lunar or semi-tidal day apart, and
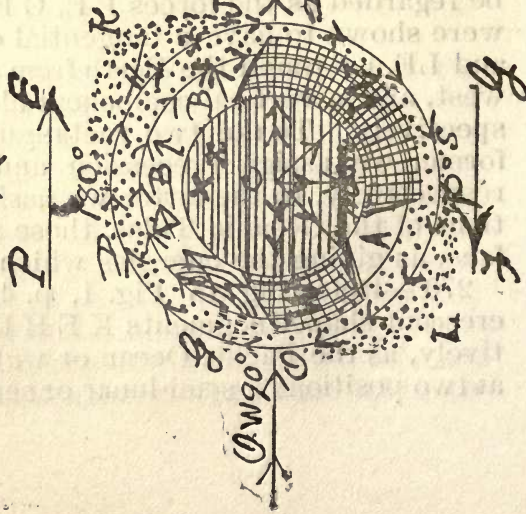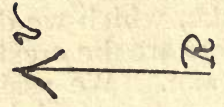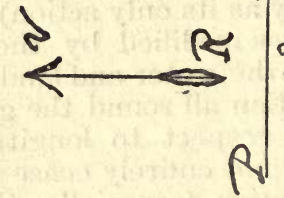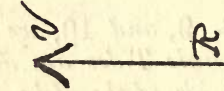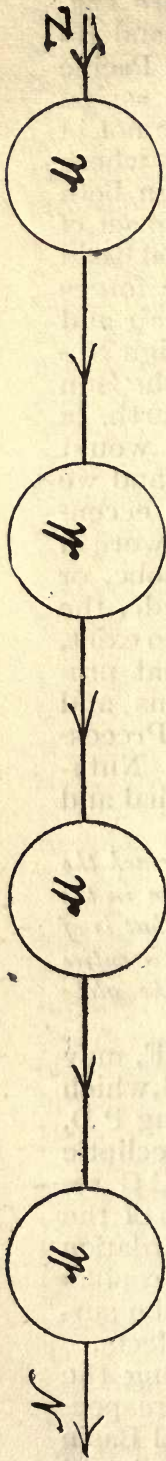
Conjunction. Fig. 7.
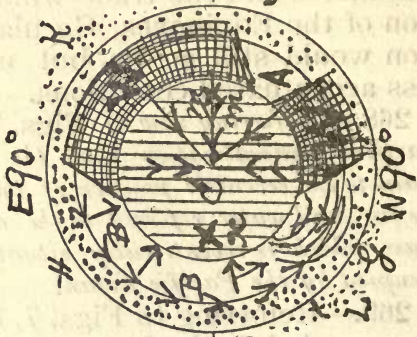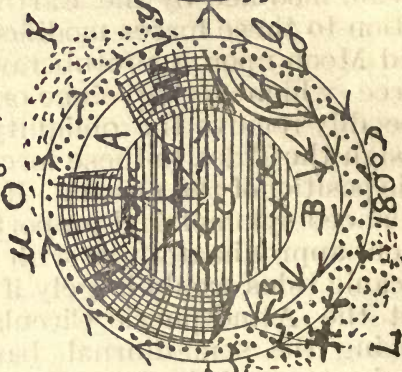
Quadrature. Fig. 8.

Opposition. Fig. 9.
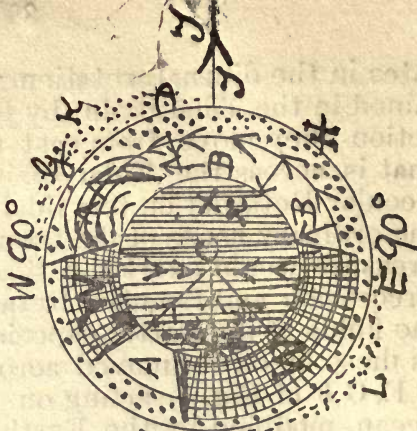
Quadrature. Fig. 10.

regarding the Figure D H L K as representing the rotating Earth. Let the centre of gravity of the fluids K E H D be situated in C E at a point near E. Initially let E be at the 6 a.m. position near K, and the crescent K E H D in quadrature with M, then in passing from K to H round the arc of rotation K D H. that is from the 6 a.m. to the 6 p.m. position in respect to the orb M, the waters are losing time in the daily rotation, and so when the solid globe has rotated through 12 honrs the waters now near quadrature with M on the side H have rotated through a little less. Again, as the segment of fluids or waters of the Tidal Basin pass from H to K that is from the 6 p.m. to the 6 a.m. position, they are again losing time by the action of the component of the force L F— G F directed along L F. Thus at all times, unless when exactly at quadrature with the orb M, the oceanic waters of the Tidal Basin are losing time in the daily rotation developing a movement of the ocean waters from east to west but in the greatest degree when the waters are directly under the tide raising orb or orbs. This loss of time by the ocean waters making impact against the rotating Earth appears as Secular Retardation.

271.—Passing now to Figs. 7, 8, 9, and 10, which diagramatically illustrate the same things. P E, G F of these Figs. represent the forces shown in Fig. 1, p. 44, the Precessional, Secular Retardational, Nutational, and Tidal forces. Let X be the centre of gravity of the excess of fluids of the Tidal Basin and represent their mass over the amount of fluids upon the opposite side of the globe. Then in Fig. 7, the mass is moving faster in the orbit than the Earth's centre; in Fig. 8, X posseses the same velocity as the Earth's centre; in Fig. 9 X is moving in the orbit slower than the Earth's centre; in Fig.10 X again moves in the orbit at the same velocity as the Earth's centre, about the Moon or Tidal Orb M; where O T represents a portion of the Earth's orbit about the Moon or i. e. about the Tidal Orb M, and ZN a portion of the Moon's orbit about the Earth; of course not to scale nor curvature, but only agreeable to relative directions pursued, the revolutions of the two bodies about each other being approximately from west to east. In Fig. 7, the Pacific ocean waters or centre of the Tidal Basin B B, by losing time in the greatest degree and moving along the direction P E, and with a vertical component of motion along the direction C R V, are being withdrawn from the Galapagos from near G, from 90° W. Longitude, and so ebb tide is now moving fastest in

this region, the time being about 6 p.m. at the Galapagos, referred to the Tidal Orb M, which may be regarded as both the Moon and Sun if the Figs. 7, 8, 9, and 10 be taken at the establishment of the tides, and about 2 hours past this position of the quadrature of the Galapagos G or 90° W with the Tidal Orb M, it will be slack water on the ebb tide in this region, a phase which will be transmitted successively round the Tidal Basin from east to west as the Earth by further rotation comes into the position of Fig. 8. In Fig. 8 the component of the force P E directed along R V has ceased to act, and also that directed from east to west, in short, the whole force P E in respect to the centre of gravity X of the fluids of the Tidal Basin B B has ceased to act, and the waters return upon the Earth by terrestrial gravitation and *reaction*, as shown by the radial arrows directed inwards towards C in the waters B B and solid Earth C W, the ocean and Earth which had been partially separated now seeking one another and the waters seeking their normal level under the influence of terrestrial gravity. Thus in Fig. 7 the waters move centrifugally-radially along C R V, and tangentially east to west along G D J by *action* at the conjunction of the Tidal Basin B B with the Tidal Orb M withdrawing the waters from the Galapagos and giving rise to trough phase there, while, in Fig. 8, as shown, they move centripetally-radially along X C, and tangentially-radially from west to east along H D G by reaction at the quadrature of the Tidal Basin B B with the Tidal Orb M and thus pile upon the Galapagos near G, and acquire crest phase in the region of 90° W. longitude, the flow tide moving fastest at the Galapagos or that is in the region of 90° W. in the position of Fig. 8, at local time about 12 o'clock at the establishment of the tides, and it is slack water on the flow tide about 2 hours after this at the Galapagos at 2 o'clock local time; and from the Galapagos, the crest phase produced in this region is radiated and transmitted to every part of the Ocean. In Fig, 9 similar conditions prevail to those of Fig. 7 by the operation of the force G F acting on the waters of the Tidal Basin B B, and the force P E acting on the solid globe WW, producing at the Galapagos or i.e in long. 90° W. similar conditions to those of Fig. 7, by the tangential component of the force G F directed from east to west, and the vertical component of the force G F directed away from C upon the waters of the Tidal Basin B B. Thus in Fig. 9 the ocean waters are again losing time in the greatest degree and are being tangentially and radially

withdrawn from the Galapagos, again producing trough phase of the tides in this region, slack water on the ebb tide occuring at 8 a.m. Galapagos time. In Fig. 10 the force G F ceases to act, and as with Fig. 8, the waters again return upon the Galapagos upon the region of 90° W. long. and flowing produce crest phase in this region by the operation of *reaction* and terrestrial gravity.

272.—Thus we have seen that consequent upon the eccentric position of the fluids of the globe, and of their centre of mass and gravity (and this refers to the air as well as the water of the Tidal Basin BB, vide Figs. 7, 8, 9, and 10) the ocean waters are varying their velocity through space, moving *en-masse* alternately faster and slower than the solid Earth ; that both the increase of velocity of the orbital motion when outrunning the solid Earth and the decrease of velocity when falling behind the solid Earth in the orbit, moves the waters round the Earth from ecliptic east to ecliptic west, with a compo- nent of motion from east to west, and causing the waters to lose time in the rotation; and to make Secular Retar- dation impact with the rotating Earth. In respect to the atmosphere, to the extent to which the air is eccen- trically placed on the side of the Tidal Basin, and with regard to its variation of velocity in the orbit through space, alternately outrunning and falling behind the solid Earth, this is a force acting to make the atmosphere lose time in the rotation, and the air to move from east to west generating trade winds, and the easting thereof, and making Precessional and Secular Retardation impact against the rotating globe, by acting on the sail area of the oceanic waves both tidal and wind produced, and the land projections of the Earth, the movements ef the fluids air and water from east to west, both contributing to the whole amount of Precession, Secular Retardation Nutation, and Tidal force.

273.—The exact ratio of the oceanic and atmospheric motions under the forces P E, G F of Fig. 1, in the phe- nomena of Precession, Secular Retardation, Nntation, and the Tides, can only be determined when the qualita- tive aspects of the question as set forth in this treatise have been fully recognised ; and since in dealiug quanti- tatively with the subjects, under false premises, there has already been so much misapplication of mathematics and so many absurd inferences, and so many crudities propounded, we must be very careful in accepting so- called mathematical conclusions. In this question of Precession, Secular Retardation, Nutation, Atmospheric

and Oceanic Circulation; and the Tides, acute percep-
tions, common sense, and ordinary mechanics, must have
the first place, then, when a proper judgment is formed
and proper estimates of cause and effect are made, and
all in their proper relation, then mathematicians and
mathematics may be called in to finish the process, and
apply the results.

274.—All force or motion, is motion in continuation.
Thus if we take the end of a rope in our hand, and by a
motion of our arms, throw it into a series of waves, all
these waves have been derived from the point of applica-
tion of the motion of our arm, which motion of the arm
has been derived from that of the molecules or par-
ticles of food we eat, and air we breathe, derived in con-
tinuation from the illimitable energies of the universe.
Similarly the tidal waves are motions of continuation de-
rived as it were from a moving arm, the *en-masse* tangen-
tial and radial oscillation of the Pacific Ocean or for that
matter of the entire ocean, in respect to its eccentric po-
sition on the Earth as diagramatically represented in
Figs. 7, 8, 9 and 10, and the region of the Galapagos is
the point of application, the end of the Tidal-wave-rope,
from which the force of motion of the oceanic arm as it
moves to-and-fro tangentially and radially in its accelar-
ation and retardation in space with respect to the move-
ment of the solid globe, is transmitted and radiated from
crest to crest and trough to trough of the series of Tidal
waves in a manner exactly analagous to the transmission
of waves along a rope, and in which trough and crest
may be taken to represent equal forces, and in which the
Galapagos may be regarded as the point of application of
the force of the oceanic oscillation or tidal arm. Thus we
must not assign the tidal waves to that of the Galapagos
regarded as a reservoir of force formed there and then
dispersing, but rather regard the tangential and radial
oscillation of the Pacific or ocean waters in their entire
mass as the arm or reservoir of force, but operating from
the Galapagos as the end of the tidal wave system, or
centre of radiation from which all the tidal waves are
transmitted ; as the point of attachment as it were of the
series of tidal waves to that motion or force of the entire
ocean which produces them, a force or motion, as with
the rope, passing from wave to wave, from crest to crest,
and trough to trough, by mutual contact and im-
pact, all along the entire course of the tidal waves, so
that the whole, embracing six crests and six troughs, four
of which are distributed quadrantly about the equator,

are vibrating seri-sychroniously as one system with absorption of force or motion and wave production at every point of the system. But in producing a wave on a rope, a to-and-fro motion is required, and equally with the oceanic tidal waves a to-and-fro motion must be needed to initiate, produce, and sustain them, and this we have shown to exist both tangentially and radially in respect to the conjunctions and quadratures of the fluid extension of the Pacifie with the Tidal Orb, The dimensions of the tidal waves and the energies of movement of the tidal system, are such as only to consist with a tangential and radial oscillation of the entire mass of the ocean as the motion or force which originates, produces, and sustains them, arising from the action of P E and G F of Fig. 1 and context, that is of orbital force, and this force has been shown to possess tangential and radial components, which we estimate possess an energy equal to that of all the phenomena which we have assigned to them, including the energies of the ocean tides, and to which alone the latter appear to be due.

275.—Given a variation of east to west trade wind force in a semi-lunar day or tidal interval, synchronating with the ebb and fiow of the tides in their origin, as there certainly is, there is also a variation of meridional force so that the ocean waters are alternately blown or compressed into the equator increasing its protuberance and retire decreasing its protuberance. This variation of wind force will stand related to the position of the barometrical maximums K and L of Figs. 4, 7, 8, 9 and 10, and will act to modify the height of the tides.

276.—In their entire aspect and bifurcation the oceanic tides are variously produced, and affected by many modifications almost as complicated as those which affect the weather ; barometric variations and fluctuations of the winds, more especially the equatorial-semi-diurnal barometric variation, and geographical conditions, play a very important part in the producing of the tides, but amid all the variety of movement, we see Precession of the Equinoxes, Secular Retardation, Nutation, Trade-winds, and Anti-trades, the principle Oceanic Currents, and the clock work regularity of the Tides, standing out clearly as average results of the orbital forces which produce the Tides. Precession never ceases, Secular Retardation never ceases, Nutation is now to one side, now to another, but possesses an average result which may be predicted, the Oceanic Tides vary in height but flow regularly in definite times but under conditions

which may for the most part be predicted, the Oceanic Currents affect definite courses which may for the most part be observed, charted, and predicted, and the average movements of the Atmosphere if we could only gauge them, are almost as regular as those of all the other phenomena named; all the phenomena just named arising from one common cause viz. Orbital Force under the operation of the primary movements of the Earth, Moon and Sun through space, and their mutual gravitations, and if we had the power to properly apply orbital force and gravitation to all the conditions, we could predict every effect both seasonal and local. But the first step to any real advance in meteorological science of any service must be the total abandonment of that theory which assigns the Atmospheric Circulation to thermal convection, and the recognition of the views of this treatise, which regard the Atmospheric Circulation as due to gravitation of the Sun, Moon. and Earth, acting directly on the fluids of the atmosphere, chiefly through the medium of the orbital motions in space their perturbations, and the Earth's rotation, and without the aid of thermal convection. This may be a doctrine as unpleasant to the present school of learned men, and to their pet societies, as the announcements of Copernicus accepting the Pythagorean views that the Earth turned round, and of his own views that it moved round the Sun in contradistinction to the views then prevailing that the Earth stood still, were to the schools of his day, but it is a doctrine as necessary just now to the progress of science, as were the views of Copernicus in his time, and calculated to dispense with many crudities which have done duty as science for much too long a time, and that in the very highest quarters.

277.—In 140, p. 34, we proposed to demonstrate that Cor. 20, Prop. 66, book 1, Principia, is absurd, and now proceed to do so. This Cor. and context declares that Precession is due to gravitation of the Sun and Moon acting on a rotating protuberant equator of the Earth's solid globe.

PROPOSITION 1.

278.—The action of solar and lunar gravitation upon the rotating solid protuberant equator of the Earth, or the mutual actions of these forces and the diurnal rotation, cannot produce a movement of the nodes of the terrestrial equator, unless annual and lunational nutations of equal force in opposite directions possessing no Precessional displacement or resultant, and so cannot produce

Precession of the Equinoxes, and to suppose that the action of solar and lunar gravitation upon the rotating solid protuberant equator or the mutual actions of the gravitations and the rotation upon the solid protuberant equator, do produce the Precession of the equinoxes, is absurd. In Fig. 2, p. 47, let W D E V be the rotating protuberant equator of the solid Earth, N C S the polar axis, D C V and W C E rectangular diameters of the Earth in the plane of the protuberant equator, and in rectangular meridian planes, or that is, in the planes of the solstitial colures N D S V and E N W S respectively, then N C S, W C E, and D C V are rectangular to one another. Let the Sun move relatively round the Earth in the orbit K D L V denominated the plane of the Ecliptic, and in the direction or order of these letters, with D the ascending node of the Sun passing north at the vernal equinox, and V the descending node of the Sun passing south at the autumnal equinox. Let the Sun be in the summer solstice in C L produced or at the winter solstice in C K produced; then the resultant of gravitation of the orb on the protuberant solid equator is in the solstitial plane E N W S, and in this direction, and so by acting on the protuberant equator, whether the equator be stationary, rotating at intermediate speeds, or rotating at an infinite velocity, by the second law of motion, as given in the Principia itself, the Sun can only act on the protuberant solid equator to reduce the angle R C E or i.e. N C P or i.e. the obliquity of the ecliptic. But if we take the orb at any intermediate declination of either the northern or southern hemisphere of the Earth, then during the transit of either hemisphere; within the limits of the altitude attained 23°27′in the case under consideration twice during the transit of either hemisphere, the orb comes to any given declination, and at equal distances upon opposite sides of the solstitial meridian or colure, (though if the distances do vary slightly it does not affect the conclusions of the argument) and though there is nutation of the Earth's axis and nodes in Precession and declination for intermediate declinations of the contiguous quadrants, yet the two nutational deflections for the two members respectively of each pair of declinations for opposite sides of the solstitial meridian or colure, are equal and oppositely directed each to each, and when a whole transit or whole passage of the orb from node to node, that is from D to V or V to D of the figure is considered, there is no Nutation either in Precession or latitude but only outstanding deflection

of the plane of the protuberant equator in the one direction viz. E N W S, and a corresponding reduction of the angle of obliquity L C E or i.e, N C P ; and a removal of the obliquity of the ecliptic exactly proportionate to the energy of the force E N W S regarded as the resultant of the entire action of the Sun for a whole year or revolution. When a whole passage of the orb from node to node is taken, the mean of the force of gravitation of the orb on the solid protuberant equator and embracing that for every possible pair of declinations, is in the solstitial meridional plane, and so for a whole revolution of the orb, the whole resultant force of gravitation of the orb on the protuberant solid equator acts in the solstitial meridional, or i.e. the solstitial colure plane, and in the direction E N W S, and thus we may consider the whole force in respect to its effects upon the solid protuberant equator or ring, as a force in this plane, and as just stated it is a force acting to rotate the Earth in the direction E N W S on the nodal line or axis D C V, and so only acting to reduce the angle N C P, or that is the obliquity of the ecliptic, and there is no other action in respect to gravitation of the orb on the protuberant solid equator. If we regard Precession of the Equinoxes as a rotation of the Earth in the plane N D S V, and in this direction, and that the force of gravitation of the orb acting on the protuberant solid equator is in the plane and direction E N W S rectangular to N D S V as just shown to be ; then the diurnal rotation W D E V, together with that by reason of the protuberant equator and solar gravitation E N W S, being in planes rectangular to that of the rotation N D S V, it follows, that E N W S and W D E V cannot produce the Precession, for it is impossible for a force or motion to produce a motion rectangular to itself without an intervening or assisting medium or force, and so for two rectangular forces or motions to produce a third motion rectangular to both. But on the other hand, if we regard Precession as a rotation of the Earth in the plane and direction L D K V, i.e. in the ecliptic plane on the ecliptic axis P C A, and displacing the nodes D and V in a retrograde direction in this plane, while preserving the angle of obliquity N C P constant ; then this rotation also is rectangular to E N W S, and so the latter acting alone can contribute no share of the displacement of the nodes constituting Precession. Again, the force of Precession L D K V can be resolved into the forces L W i.e. E D W V directed against the diurnal rotation, and L X i.e. N D S V rectangular to both N W S E

and the diurnal rotation, then L X or i.e. N D S V is rectangular to both W D E V and E N W S, while LW or i.e. E D W V is rectangular to E N W S and directly opposed to W D E V, therefore, as before, E N W S and W D E V acting on a protuberant solid equator cannot produce the rotation of the Earth L D K V or displacement of the nodes D and V constituting Precession of the Equinoxes, or if we say that they do, then we say that a force can produce a motion directed against itself without the aid of recoil or any other impact or force, and also that a force acting in one plane can produce a motion in a plane rectangular to that of its action without an intermediate or assisting agency or force, both of which declarations are contrary to the laws of motion and absurd, therefore E N W S and W D E V acting in combination cannot produce Precession of the nodes, that is of the Equinoxes, and to assert that they do so is absurd. The proof that the Moon cannot produce Precession of the Equinoxes is the same or similar to that for the Sun, but substituting the word Moon for Sun, aud lunarstice for solstice, therefore the assertion that the Sun and Moon by their gravitation on the rotating protuberant equator of the solid Earth produces the Precession of the Equinoxes is absurd; wherefore, Cor. 20. Prop. 66, book 1, Principia is absurd. Q.E.D.

Cor. 1. Since the obliquity of the ecliptic is not removed but remains practically constant, there is another force equal to that of gravitation of the Sun on the protuberant solid equator but acting in the contrary direction i.e. acting in the solstitial colure in the direction W N E S, where these letters indicate the poles and cardinal points respectively, as illustrated in Fig. 2, p. 47.

Cor. 2. There is a force acting in the plane and direction N D S V N i.e. in that of the equinoctial colure to rotate the Earth on the cardinal diameter W C E, and this force is other than that of gravitation of the Sun and Moon acting on the protuberant solid equator of the Earth, and rectangular thereto, being in a plane rectangular to that of the action on the protuberant equator.

Cor. 3. Gravitation of the Sun and Moon on a protuberant solid equator acting in the direction E N W S E limits the action of the force W N E S of Cor. 1.

Cor. 4. A force L D K V besides giving the component N D S V of Precession of the Equinoxes would possess a larger component E D W V giving Secular Retardation.

Cor. 5. The force L D K V is an impact of fluids.

Cor. 6. Lateral pressure of Fluids moving against the rotating Earth, or along LDKV, acting meridionally on the protuberant solid equator would give the force of Cor. 1.

Cor. 7. The impact of fluids L D K V is due to nutations of the Earth and its fluids in the orbit about the Sun and Moon, and is produced by the primary motion and centripetal force of gravitation to these bodies.

Cor. 8. Nutation is due to intervariation of all the forces under consideration, with special reference to the change of plane of the lunar orbit and points of impact of the fluids with the rotating Earth and protuberant equator.

Cor. 9. The forces of Precession, Nutation, and Secular Retardation in their energy and as maintained and perpetuated in their operation, are kinetic, consisting of fluid motion of air and water under the tangential force of the Earth and its fluids in the orbit and recoil from the Earth's rotation, and of the centrifugal forces of gravity directed to the Moon, Sun, and Earth.

Cor. 10. The kinetic resultant of the motion of the fluids of the atmosphere and ocean and embracing the sum of the actions and reactions in relation to the rotation of the Earth and orbital motions of the Earth about the Moon and Sun, however much the force may vary geographically and quadrantly in the diurnal rotation, is constantly directed round the Earth in the plane of the orbit from orbital-plane-east to orbital-plane-west, i.e. in the direction approximately L D K V L of Fig. 2 in respect to action, and in the reverse direction in respect to recoil of the fluids or reaction.

Cor. 11. The whole force urging the atmosphere and ocean in the direction L D K V L at any given moment is proportionate to that of Precession, Nutation, and Secular Retardation, regarded as one phenomenon.

N.B. The second law of motion as given in the Principia and Cor. 20, prop. 66, book 1, Principia, cannot both be true.

279.—Sir Isaac Newton, Principia, Book III. in his "Rules of Reasoning in Philosophy" says

RULE 1.

"WE ARE TO ADMIT NO MORE CAUSES OF NATURAL THINGS THAN SUCH AS ARE BOTH TRUE AND SUFFICIENT TO EXPLAIN THEIR APPEARANCE." "To this purpose the philosophers say that nature does nothing in vain, and more is vain when less will serve; for nature is pleased with simplicity and affects not the pomp of superfluous causes."

280. We think that Newton in his love of simplicity

and under the domination of the thought that "more is vain when less will serve," and in his desire to reject "superfluous causes'" often omitted much from his equations and demonstrations which was needed to render them complete and "sufficient to explain appearances," while many of his conclusions are not only faulty, but absolutely untenable and false. "There are crooked things which cannot be made straight"and there are complicated things that cannot be made simple, and what nature does love is variety rather than simplicity, and while not affecting pomp, she is magnificent in her parts without affectation, but all in harmonious concord and without confusion.

281.—The Tides of the ocean at once present our view with complications and concord, and under conditions which cannot be reduced to a few simple propositions and tenets, such as those of the school and text books, and even such as those of the views of Sir Isaac Newton himself as given in the Principia, and upon which the former are based. But according to rule iv. Principia, "IN EXPERIMENTAL PHILOSOPHY WE ARE TO LOOK UPON PROPOSITIONS COLLECTED BY GENERAL INDUCTION FROM PHENOMENA AS ACCURATELY OR VERY NEARLY TRUE, NOTWITHSTANDING ANY CONTRARY HYPOTHESIS THAT MAY BE IMAGINED TILL SUCH TIME AS OTHER PHENOMENA OCCUR BY WHICH THEY MAY BE MADE MORE ACCURATE, OR LIABLE TO EXCEPTIONS. This rule we must follow, that the argument of induction may not be evaded by hypotheses."

282.—Observations of the tides have multiplied since Sir Isaac Newton's time to such an extent, that these observations present us with results which may be denominated "experimental" nature herself performing the experiments, with the solar system as her laboratory, and the Earth and ocean her apparatus. The view of the Tides in the Principia must now be regarded as the hypothetical one, and though advanced by Newton, it must not be allowed to evade the arguments of inductions which can now be made from a vastly greater body of observations than those at the command of Newton. The hypotheses of Newton with regard to the tides, and for that matter his hypotheses generally, must be only regarded as stepping stones to better views. Of his four "Rules of Reasoning in Philosophy" prefatory to Book III. Principia, only Rule ii. can be admitted without serious reservations and qualifications either with regard to the rules themselves or the appended illustrations and remarks.

283.—Reasoning by induction from observations of the Tides as recorded in Tide-Tables and shown by the lines of a co-tidal chart, the following propositions " collected by general induction from the phenomena" appear to be accurately or very nearly true, viz.

Prop. 2.

The Oceanic Tides are in the main due to *action* and *re-action* of the fluids of the Ocean or Tidal Basin, air and water, as these move in the Secular Retardation impact from east to west at the conjunctions and oppositions of the air and water with the Tidal Orb produced by the diurnal rotation of the Earth ; and return or react from west to east at the quadratures or morning and evening positions of the air and water to the tidal orb.

Prop. 3.

There is in general a diurnal tide due to the operation of the Precessional component of the Precessional Secular Retardational impact, operating over the Pacific and Atlantic, alternately ascendingly and descendingly, the ascending and descending resultants being separated by a semi-lunar or i.e. a semi-tidal day. The ascending component of the fluid motion; that of the air and water; increases the tides on the shores of Britain, the descending component decreases the tides on the shores of Britain, and by a law such, that in winter the morning tides are under the ascending component in respect to the influence of the Sun, and the evening tides are under the descending component in respect to the influence of the Sun, and so the morning tides average higher than the evening tides. In Fig. 2, p. 47, N D S is the descending component, and S V N the ascending component of the Precessional - Secular - Retardational impact, passing through the respective nodes. In winter NDS is the evening impact and S V N the morning impact, while in summer the conditions are reversed.

Prop. 4.

The wave length of the Tidal wave is the length from crest to crest of a tide whether primary or secondary, and is variable in different parts of the globe. The period of oscillation, alike for all tidal waves, is a complete to-and-fro oscillation in a tidal interval i.e. in a semi-lunar or semi-tidal day.

Prop. 5.

The forces of action and reaction of the Secular Retardation; the primary forces giving rise to the tides, are kinetic movements of the fluids of the air and water of the Tidal Basin directed respectively round the Earth

from east to west and west to east; with the respective resultants in the plane of the equator.

Prop. 6.

The forces of action and reaction giving rise to the diurnal tides of the Precessional component of impact; are kinetic movements of the air and water of the globe directed respectively from north to south, and south to north; with their resultant acting at intervals of half a lunar or tidal day.

Prop. 7.

The forces of action and reaction of the Secular Retardation, the primary forces giving rise to the tides, are in the main tangential movements of the fluids of the Tidal Basin round the circle of the Earth, but with a vertical component of force also, and further, by impact and by convection developing radial movement and oscillation with the resultant on the equator.

Prop. 8.

The Tidal crests are developed approximately in quadrantal positions differing by 90°, by conjunctions and oppositions of the fluids of the oceanic or Tidal Basin, with the Tidal orb, in respect to the regions of development.

Prop. 9.

The continental portions of the globe may be said to have a windward and leeward side in respect to the motions of the air and water of the globe, more particularly of the Tidal Basin. In respect to the action and reaction of Secular Retardational force the eastern shores of the old world and the western shores of the new world are the windward sides respectively, but at intervals removed 12 tidal hours apart. By the rising and setting of the Tidal orb and the daily course thereof round the Earth, the windward and leeward forces are alternately brought into play in a given region to produce the tidal waves. The winds in their actions on the tides may be said to vary quadrantly in the diurnal rotation.

Prop. 10.

The trade winds and anti-trades as affecting the entire Earth, have an alternating quadrantal variation of force in the diurnal rotation, in two quadrants the given force of action or reaction is increasing, and in two quadrants decreasing, the change of average wind force being effected synchroniously with the development of the tides, and acting as a tide producer affecting the height of the tidal waves and positions of the tidal phase. The quad-

rantal variation of trade wind and anti-trade wind force in a tidal day is respectively in opposite directions, increase of the one being marked by decrease of the other and vice versa, in respect to the fluids of the eccentric.

Prop. 11.

There are barometric changes of quadrantal variation accompanying and affecting the development and height of the tides.

Prop. 12.

With the Moon and Sun in conjunction at new Moon in the equator, the east to west or action forces of the tides extend round the Earth in the quadrants possessing a time range of 4 a.m. to 10 a.m. and 4 p.m. to 10 p.m. respectively, while in the quadrants possessing a time 10 a.m. to 4 p.m., and 10 p.m. to 4 a.m. alternate to the above, the west to east or forces of reaction prevail. This is especially the case with reference to the effects of the semi-diurnal barometrical maximums of the Sun.

Prop. 13.

The forces of *action* and *reaction* acting on the air and water and encountering motion of unmoved fluid or the solid Earth, are equally competent to raise a tidal crest, and inertia must itself be regarded as a force in this connection.

Prop. 14.

The quadrantal variation of trade wind and anti-trade wind force is equivalent to a quadrantal variation of east to west and west to east impact and pressure on the ocean waters alternately superposed over a whole quadrant of the globe, or of the waters ef the ocean, and with the greatest oscillation of force on the equator in respect to the Secular Retardation resultant of movement and impact of the fluids. This quadrantal variation of the wind, forces the ocean into a quadrantal oscillation with its tidal crests quadrantly placed.

Prop. 15.

The east to west quadrantal force which develops tidal crest at the Galapagos, develops tidal trough at a point 45° further west, while the west to east force which develops tidal crest at Borneo develops tidal trough at the Galapagos.

Prop. 16.

The quadrantal forces of wind variation develop two phases of tangential piling and *compress* of the ocean waters in regions removed 180° apart, and two phases of tangential removal and *rarefaction* removed 180° apart. These phases of compress and rarefaction synchronate

with tidal development and force, and determine the
period of oscillation, giving for each region two tides,
(each an ebb and a flow) per lunar or tidal day. The
length of the tidal waves is determined by the ocean
depth and that superposition of the elementary units
and waves of vibration which is in keeping with a
semi-diurnal period of oscillation. This period requires
quadrantal positions of the tidal waves round the equa-
tor of the globe, with crest and trough in the alternate
octants, a condition modified by variations of oceanic
depth affecting the wave length and velocity.

Prop. 17.

The lesser is comprehended in the greater. The action
and reaction view of Prop. 2 and 3 in relation to the
Secular-Retardational-Precessional impact comprehends
all wind, current, and tide effects of air and ocean, winds
and tides being the manifestations of the action and re-
action of the fluids of the air and ocean under Preces-
sional-Secular-Retardational-Nutational force, and the
latter largely called into action by the eccentric position
of the fluids of the globe upon the Pacific Ocean side of
the globe, this eccentricity giving rise to a polarised os-
oscillation of the fluids, which polarises all the tidal
effects on the Galapagos and Borneo, near Ecuador and
Sumatra, on an equatorial diameter of the Earth which
is at once the tidal axis and the Seismological axis of the
globe.

Prop. 18.

The arrangement of Seismological effects to the ocean
and tides and to the position of the tidal axis, are such
as to indicate that they are correlated phenomena, and
that the former equally with the latter, are produced by
the Precessional-Secular-Retardational forces P E, G F
of Fig. 1, p. 44, and by that movement of the external
fluids of the globe as they are operated upon by these
forces, more especially with reference to the semi-diur-
nal oscillation of the fluids arising from their eccentric
position to the globe as illustrated in Figs, 7, 8, 9,and 10.

Prop. 19.

The Secular Retardation force, displacing vast volumes
of air and water, and changing their pressure on the
crust of the globe over quadrantal or hemispherical areas,
is the great producer of seismological effects; hence vol-
canic eruptions and earthquakes will prevail in greatest
number and violence when the Moon's course is lowest,
i.e. when her path round the Earth coincides most
nearly with that of the equator, and will be a minimum

in number and violence when the Moon's course is
highest, that is when her path round the Earth cuts the
equator at the greatest angle, and the Moon attains its
highest declination in the period of revolution of the
nodes, or we may say that seismological phenomena and
the height of the tides vary together.

Prop. 20.

The angle E C M (Fig. 1, p. 44) is greater for the Moon
than for the Sun by about 20° of azimuth, hence at the
establishment of the tides, the effects of the Moon and
Sun are not perfectly superposed, and the tides do not
rule highest, until the Moon has advanced on her
monthly course, by about 20° of longitude.

Prop. 21.

In the kinetic and pressure impacts of the air of the
Tidal Basin, the fluids of the ocean are moving in a man-
ner not unlike that of the mercury of the barometer sub-
jected to variation of pressure, and not unlike how the
mercury would move were the barometer so constructed
as to form an anemometer. The tides in their develop-
ment are the average expression of this movement of the
air and its hemispherical or quadrantal variations as
these give rise to trade wind and anti-trade wind force.

Prop. 22.

The directions and forces of the atmospheric circula-
tion and their interactions in their resultants and details,
and those of the oceanic circulation and oceanic tides,
are determined at any given moment by those of Secular
Retardation, Precession, and Nutation.

Prop. 23.

The whole force urging the Atmosphere and ocean into
circulation at any given moment is proportionate to that
which gives rise to Secular Retardation, Precession, and
Nutation.

Prop. 24.

The whole force urging the ocean into tides at any
given moment is proportionate to that of Secular Re-
tardation.

Prop. 25.

As the force of Secular Retardation increases that of
Precession decreases, and vice versa, by the changing in-
clinations of the lunar orbit. Hence the mean monthly
height of the tides and the value of Secular Retardation
and Precession are varying together, but the latter in
opposite directions.

Prop. 26.

Whatever view of the tides be taken, kinetic considera-

tions must take preference over all others as the force producing the tides, and equally as the force producing Secular Retardation, Precession and Nutation, without west to east impact of fluids against the rotating Earth there can be no Secular Retardation, and without a north to south component of impact of the fluids, no Precession, and without hemispherical or quadrantal alternations of impact and recoil in relation to conjunctions and quadratures of the Tidal Basin, with the Tidal Orb, there can be no tides.

Prop. 27.

The four tidal waves of the equator separated by about 90° of longitude, alternate in phase and superpose, so as to appear in any given longitude or region as two tides separated by twelve tidal hour intervals. The superposition is not always perfect, and this is one cause of diurnal tides.

Prop. 28.

Two tides per tidal day enter the Atlantic from the east originated in Polynesia, and two tides per tidal day enter the Atlantic from the west originated near the Galapagos. and these four tides received per day into the Atlantic superpose and pass up the Atlantic as two tides only per tidal day.

Prop. 29.

The superpositions of the tidal waves are comparable with those which occur in the reflection and refraction of light vibrations, the phenomena commonly known as interference; while quadrantal tides of position, but hemispherical tides of time, may be compared with that principle by which elementary vibrations are made to compose the wave front of a ray of light, a principle which may perhaps be extended to embrace every wave and ripple of the ocean as contributing to the whole tidal effect.

Prop. 30.

We may regard the two tidal troughs of the Galapagos as due to the operation of *action*, and the two tidal crests as due to the operation of *reaction* thus giving rise to two complete tidal waves in this region by the operation of four quadrantal forces. And similarly for each region possessing tide raising force. The region of Borneo regarded as alternately a windward and leeward shore of the old world dam, appears to possess a tide raising force only secondary to that of the Galapagos.

Prop. 31.

The tides of the Atlantic shores are high, as compared

with others of the globe, because the Atlantic re
ceives west going tides from the region of Polynesia, and
east going tides from the region of the Galapagos, the
two sets of tidal waves being received in the Atlantic
under conditions of superposition and double phase.

Prop. 32.

The primary tides of the ocean are two tidal waves
lying immediately to the east of the meridian of Tahiti
and to the west of the meridian of Tahiti respectively,
the former radiating eastwards and polewards, the latter
westwards and polewards, the two radiations superpos-
ing and polarising in the Atlantic, and as a superposed
and polarised oscillation passes up the Atlantic to the
north polar regions, crest and trough, ebb and flow,
both being radiated from the Polynesian oscilla-
tions lying respectively to the east and west of Tahiti
as given, and of which Tahiti is always a node, and in a
manner such that Tahiti may be regarded as in a tideless
sea, any diurnal oscillation of level of the ocean waters
at Tahiti being due to other causes than those which
produce the semi-diurnal or lunar tides.

Prop. 33.

Tahiti is the node of the tangential oscillation of the
fluid eccentric of the globe under the forces P E,G F of
Fig. 1, p. 44, and as illustrated in Figs. 7, 8, 9, and 10,
and so possess no tide in respect to this oscillation, the
tidal effects radiating from the Tahiti node, by an alter-
nate rise and fall of the waters of the ocean east and west
of the node, a rise and fall which is propagated east-
wards and westwards and outwards in directions away
from the Tahitian node.

Prop. 34.

The 24 hour tide, with high water at noon, the only
tide at Tahiti, marks a change of level of the entire
Pacific Ocean, and for that matter of the entire Ocean,
of which Tahiti being in a tideless sea, is the index.
[N. B. This change of level appears to be due to an ec-
centric position of the Earth's centre of gravity, which
at all times appears to lie upon the side of the Earth next
the Sun, and so is relatively revolving round the Earth
from east to west, and the ocean waters endeavour to
take the form of a sphere round the centre of gravity,
and thus give rise to the noon elevation of the ocean
waters around Tahiti, forming its noonday flux, the only
elevation of that region, and which flux only respects the
position of the Sun, and always occurs at noon, no matter
what may be the position of the Moon, and only respects

the position of the Sun as a flow tide in respect to conjunction at noon and as an ebb tide in respect to opposition at midnight, and therefore is not produced as the tides proper are produced, because with respect to the latter, both conjunction and opposition of the orb synchronise in period with a complete ebb and flow of the tide, giving two complete ebb and flow tides per tidal day, as against one per solar day at Tahiti.]

Prop. 35.

The modification of the height of the semi-diurnal or lunar tides constituting the diurnal inequality, is largely due to the 24 solar hour gravitational change of position of the Earth's centre of gravity, with corresponding changes of level of the ocean of which the index is at the Tahitian tidal node ; this change of level appearing at Tahiti as a tide of 24 solar hour period, with high water at noon, and low water at midnight, and is the only tide of this region of the ocean. This 24 solar hour tide which we may call the gravitational eccentric, is world wide in dimensions, a protuberance in one hemisphere of the globe, a depression in the other, affecting the height of the tides on every shore, on the average elevating their calculated or normal height in the hemisphere of the globe illuminated by the Sun, depressing them in the nocturnal hemisphere, i.e. in respect to direct action, but setting up currents of the ocean, more especially in the higher latitudes, possessing indirect effects and producing diurnal inequalities of various characters, according to the directions and set of the currents.

284.—That oceanic protuberance with its greatest elevation near Tahiti at noon, and its greatest depression near Tahiti at midnight, from day to day all the year round, produces a diurnal change of level of the ocean at Tahiti of 1¼ feet, and the eccentricity of the centre of gravity of the Earth, that is, its departure from the centre of form, will be such, that its diurnal east to west orbit round the centre of form will possess a major axis exceeding this amount, for consequent upon the rapid rotation of the Earth the full change of level of the ocean in the gravitational eccentric is never equal to that of the forces producing it, or to the change of form of the ocean which the forces could produce were the Earth more stationary. This east to west movement of the oceanic eccentric with the Tahitian culmination, contributes a share of the Precessional-Secular-Retardational impact, and correlated oceanic currents.

Prop. 36.

Whatever be the value of the force of Precession regarded as a force rotating the Earth in the meridian of the equinoxes, descendingly in respect to the tangent passing through the vernal equinox, and ascendingly in respect to that passing through the autumnal equinox, and modified by the attraction of the Sun aud Moon on the protuberant equator, the combined effects producing a rotation on the ecliptic axis, this value is outweighed by the force producing Secular Retardation.

Prop. 37.

Referring to Fig. 2, p. 47, let L X or Sin obliquity of ecliptic be the value of the force of fluid impact; the kinetic of Precession, then L W or Cos obliquity is the value of the force of fluid impact producing secular Retardation, and the latter outweighs the former in the proportion L W^2 is to L X^2.

285.—In reachingthe conclusion of Prop. 37, and framing the various propositions, we have been startled to discover that Secular Retardation impact is a force of enormous power; a force so great that even in historical times, it would have removed the Earth's rotation, did not some other force exist to sustain the latter, and the calculation of the quantity of Secular Retardation given at p. 55, sect. 157, would only be true, were the two effects Precessional rotation N D S V Fig. 2, and Secular Retardation E D W V, in the proportion to each other of the forces which produce them.

286.—But with regard to the component of force L W or i.e. L W^2 this force is directed round a fixed axis, the polar axis N C S, and so its effects are those of an uniform accelerating force removing as much rotation of the Earth in a given time as it could confer if acting in the opposite direction, while on the contrary Precessional force is directed round an evanescent axis in respect to the geographical axis of the Earth or mass affected,and so the velocity of Precessional rotation is not subject to acceleration : The Roemer-Bradley ellipse of Nutation, which is due to fluid impact in the plane of the lunar orbit which is variable in position, deviating to opposite sides of the equinoctial nodes in respect to east and west by the revolution of the lunar nodes; this nutational impact though only a fractional component of the whole force of fluid impact under the orbital forces P E, G F, Fig. 1, and in the entirety producing Precession and Secular Retardation, this Roemer-Bradley Nutational impact can move the polar axis and rotate the entire

Earth to a degree such, that in the period of revolution of the lunar nodes, the Earth's poles describe an ellipse whose major axis is 19.3$''$ and smaller axis 14.4$''$, which represents a total rotation of the globe by the nutational-fluid-impact-component of Precessional force of at least the circumference of this ellipse in angle, say in round numbers a rotation of 50$''$ of arc in 18 years. But Nutation force is only a small fraction of either Precession or Secular Retardation force.

287.—As a tentative approximation it would appear that did the fluid impact P E, G F of Fig. 1, L D K V L of Fig. 2, the Precessional-Retardational impact, act round a fixed axis instead of an evanescent one, and were this axis the polar axis N C S, it would bring the Earth's rotation to a stop in a very much shorter time than 2611 years, while the Secular-Retardational-Component L W or E D W V E which is so acting, is sufficient to bring the Earth's rotation to a stop in 2911 years. Hence we are led to the startling conclusion, that there is a force rotating the Earth from west to east, equal, or approximately equal, to this force which would retard it, i.e. a west to east force capable of conferring upon the Earth in 2611 years the diurnal rotation which it at all times, or approximately at all times, possesses. Thus if the Earth is really undergoing Secular Retardation it is by the relative preponderence of the Retarding forces over the accelerating forces.

Prop. 38.

The geographical equator is the magnetic equator and the force accelerating the Earth's rotation is electric currents descending upon the Earth's magnetic poles, or possessing a resultant of motion in this direction.

288.—In electric discharge of high tension in a magnetic field the currents do descend meridionally upon the magnetic equator i.e. do descend upon the poles, and so produce rotation of the field and magnet. The writer has verified this experimentally.

Prop. 39.

The electric currents which rotate the globe will be those of lightning and aurorae.

Prop. 40.

The Sun's light and heat supply the energy of the electric currents which rotate the globe in the diurnal rotation.

289.—Necessarily the electric currents of lightning and aurorae move descendingly upon the magnetic poles of the globe by the directive influence of terrestrial mag-

netism. This is certain from experiments which the writer has made

290.—The west to east rolling clouds of the aurorae are probably correlated effects with the west to east electro-magnetic forces which rotate the Earth, while the meridional auroral streamers probably mark the descending electric currents giving rise to the the magnetically deflected west to east rolling clouds.

Prop. 41

The electro-magnetic forces which rotate the Earth are derived by induction and radiation, from the electro-magnetic and mechanical forces internal to the Sun, i.e. are the effects of the rotation or oscillation of the Sun's magnetic nucleus and external globe, are effects of rotational and orbital forces internal to the Sun.

Prop. 42.

The electro-magnetic forces which rotate the Earth are derived by induction and radiation, from the electro-magnetic forces of the Sun; i.e. the mechanics of the Earth's rotation are derived from the mechanics of the Sun, and the lesser rotation of the Earth as produced and maintained, is but a reflection as it were of the greater rotation or internal mechanics of the Sun. The Earth's rotation is a mechanical movement about its centre of gravity ; the solar forces giving rise to the Sun's radiation are mechanical movements of the Sun's matter about its centre of gravity, rotational or orbital in character. The mechanics of the Sun are either those of a magnetic nucleus, a large globe many thousands of times greater than our Earth, rotating in 1.1 second of time, or of such a globe oscillating to and fro in this period in the Sun, along with the external mass of the Sun, but in either case. it is a movement more or less apparent to observation as affecting the external limits of the Sun, and producing the rotative-scintillation of the latter, a rotative scintillation, always more or less manifest to observatton, but especially manifest when the Sun is near the horizon and eclipsed. This rotative-scintillation may itself be in our atmosphere, the effects of a pulsation of terrestrial magnetism keeping time with solar induction effects, but none the less effects marking the mechanics of the Sun.

292.—If we suppose inertia to be a constant for a given quantity of matter, the fluids of the ocean and atmosphere are in a east to west motion sufficient to effect Precession, but if as is probable—inertia and gravity increase together, then it would appear that there are

about the Earth fluids imponderable to our tests, which are assisting to produce Precession by their impact against the Earth in the orbital plane of the Moon and Sun, and acting as forces P E, G F of Fig. 1.

293.—The external limits of the Sun may be subject to rotational acceleration by the internal mechanics of the solar magnetic nucleus, but the electric discharge of the photosphere may be of direction such as to produce an electro-magnetic force retarding the external limits of the Sun to a degree equal to the accelerative influences of the magnetic nucleus but in opposite direction.

Prop. 43.

The light and heat of the Sun arises from mechanical motions of ponderable matter opposedly directed.

Prop. 44.

The light and heat of the Sun arises from mechanical motions of ponderable matter opposedly directed, of which the internal mass of the Sun engaged in such motion is strongly magnetic, with lines of force extending into space beyond the confines of the solar system, and acting directly upon the matter of comets in this system, sufficiently to affect the form of comets and the circulation of their gases in the observed effects of their approach and retiral from the Sun.

Prop. 45.

The mechanics of the Sun are such as constitute it an electro-magnetic dynamo.

Prop. 46.

The external limits of the Sun at the base of its atmosphere are cool and solid and possessed of magnetism oppositely polarised to that of the internal nucleus.

Prop. 47.

The light and heat and circulation of the Sun arises from electro-magnetic effects of the absolute and relative motions of the armature and field together forming its entire mass, and each for the most part, cool, solid, ponderable matter, but in their entirety enclosed in a fluid or gaseous envelope forming the cool atmosphere, hot photosphere, and outer chromosphere and corona.

Prop. 48.

The central forces resident in the ponderable matter of the Sun, are rotational in the nucleus regarded as a globe, are rotational in the nucleus and external enclosing sphere regarded as relatively rotating in the opposite direction, or they are orbital in respect to the motion of the nucleus and external enclosing sphere, or they are

both combined. But in any view the light and heat of the Sun is derived from the momentums of the internal and external matter of the Sun opposedly directed absolutely or relatively, i.e. movements of two ponderable masses together forming the Sun, and both endowed with magnetism and in such a way as to constitute the Sun an electro-magnetic dynamo of similar type to those of our various electric lighting and power establishments but on a vastly more magnificent scale, we were going to say, infinitely so.

<div align="center">Prop. 49.</div>

There are various ways in which we may harness and make use of the electro-magnetic forces ol the Sun to do the work of the world.

293.—But to return to the more proper work of this treatise, to terra firma, as the inhabitants of the world are not yet ready for receiving proper conceptions of the Sun, (though we could not forbear to sow a few more seeds of progress, and endeavour to lift science from the slough of passivity in which even the Newtonian philosophy has left it) we will endeavour further to deal with matters within the grasp of the most ordinary common sense, and for which it may be almost ready.

295.—Let Figs. 11, 12, 13, 14, illustrate four positions of the Moon occurring consecutively by the revolution of the nodes effected in 6793.4 days. These positions alternate successively in the order given at intervals from Fig. to Fig. of $\frac{6793.4}{4}$ days. The arrowed curve about the poles N and S, each represents the ellipse of Nutation, discovered by Roemer, and elucidated by Bradley. and which we name the Roemar-Bradley ellipse § 286, p. 110. Its major axis is in the solstitial plane or colure, N W E S of Fig 2, 11, 12, 13, and 14, and its minor axis is in the equinoctial plane or colure, N D S V of these Figs. The dimensions are, major axis 19.3″ minor axis 14.4″, and the pole N makes a revolution of th's in 6793.4 days, superposed upon the Precession N T I whose circuit is accomplished by the Precessional rotation L D K V in 25000 years. The south pole S describes in Nutation a synchronious and similar path to that of the north pole N out in the opposite hemisphere, the two cones of Nutation of the two hemispheres having the centre of the Earth for their apex. The actual path of the pole as the joint effect of Precession and Nutaton is a waved line the resultant of the combined motions of Precession and Nutation, but we may regard the Roemer-Bradley effect, as an ellipse as illustrated in the Figs.

296.—The Roemer-Bradley ellipse correctly inter-preted is a measure of the entire Precessional forces and the exchanges of action and reaction of the atmospheric Circulation, Oceanic Tides and Circulation, Secular Re-tardation, Earth's Diurnal Rotation, and Solar Radia-tion, all of which are correlated phenomena. Hence although it may appear but a small movement of the terrestrial axis, it is one full of profound meaning, and consequences of the highest import.
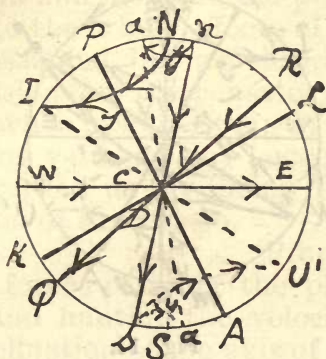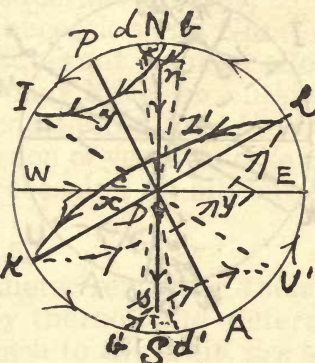
Fig. 11.   Fig 12.

297.—Fig. 11 is taken at the period when the ascend-ing node of the lunar orbit coincides with the vernal equinox. The obliquity of the ecliptic n c P for this po-sition is a maximum by about 9.6ʺ above the mean value (that of Figs, 12 and 14,) but by the precessional retro-gression of the nodes, the ascending node is about to pass into the western cardinal hemisphere N W S when the impact of the fluids of the air and ocean R D Q V, under the orbital forces P E, G F of Fig. 1 will in part be directed downwards from north to south in the vernal-equinoctial-side of the western cardinal hemisphere, i.e. in the quadrant N W S D N and upwards in the autmnal-equinoctial-side of the eastern cardinal hemisphere i.e. in the quadrant N E S V N, therefore the two impacts upon the opposite sides of the globe, in the opposite cardinal hemispheres form a couple rotating the Earth in Nutation in the direction E N W S reducing the obliquity of the ecliptic, while the great-ness of the angle of obliquity R D E over the mean value in passing from the position of Fig. 11 to thet of Fig. 12, with a correspondingly great Precessional resultant N D S V causes Precession to proceed at a greater pace than its mean rate in proportion as the angle of obliquity, R C E is greater than the mean value of the obliquity, producing effects on the Roemer-Bradley elipse culmin-

ating in the position shown in Fig.12, where n the North
Pole has made a quarter revolution of the ellipse b n d,
and Precession is now proceeding at its mean rate, and
when the ascending node of the Moon coincides with the
solstitial colure in the western cardinal hemisphere NKS.
At this time the Nutational advance in Precession is a
maximum by about half the minor axis of the Roemer-
Bradley ellipse.   But the retrogression of the lunar
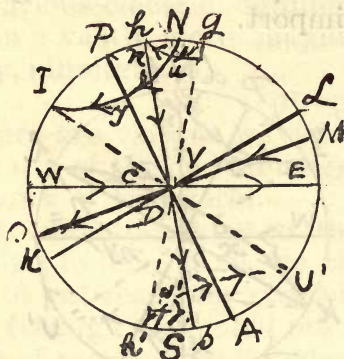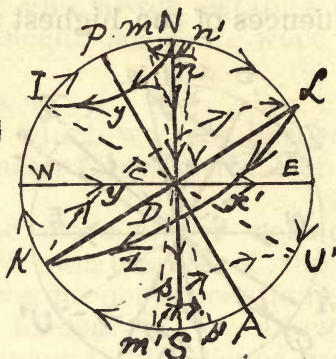
Fig. 13.   Fig. 14.

nodes continuing, we reach the position indicated in
Fig. 13 when the lunar ascending node coincides with
the autumnal equinox.   Clearly in passing from the posi-
tion of Fig. 12 to that of Fig. 13 the Precessional impact
of fluids M D Q V is impinging on the protuberant equa-
tor W D E V and moving over the Earth so as to exert
a couple on the Earth of decreasing force in respect to
Precessional impact N D S V, and also in respect to the
force of impact E D W S, which acts to decrease the angle
n C P or i.e. N C P or i.e. to reduce the obliquity of the
ecliptic, hence in the passage of the Moon from the posi-
tion referable to Fig. 12 to that of Fig. 13 the movement
of the Pole n is carried round to the position h, the ob-
liqui y of the ecliptic h c P is now a minimum and the
return of the Pole on the opposite side of the Roemer-
Bradley ellipse commences, Precessional Nutation pass-
ing into the minus sign, and obliquity of the ecliptic in-
creasing as the impact of the fluids of the air and waters
of the ocean under the forces P E, G F of Fig. 1, attain
the direction L X/ Z K Y L of Fig. 14, when the ascend-
ing node of the Moon attains its greatest eastern elonga-
tion or azimuth in the solstitial colure N E S W in the
eastern cardinal hemisphere.   The polar axis is now in
the position N C S, Nutation in Precession possesses the
greatest minus sign, the Pole being in Precession behind
the mean value by about 7.2″ calculated upon its average
advance of one complete circle in 25,000 years, while as

in Fig, 12 the obliquity of the ecliptic is a mean value.
From Fig. 14 we pass again to Fig. 11 with which we set
out, which completes these illustrations of the fluid im-
pact and variations of the couple accompanying the revo-
lution of the lunar nodes and producing the Roemer-
Bradley Nutation superposed upon Precession. The ac-
tual value of Nutation is further modified by monthly
and annual variations of obliquity and direction of the
Earth's axis and plane of rotation due to the attraction of
the Sun and moon on the protuberant equator, to which
hitherto the whole effects of Precession and Nutation has
been assigned, but which protuberant equator effects on
Precession are compensatory and have no outstanding
value when a whole year is considered, and so no out-
standing value for any succession of years, and so cannot
be regarded as producing Precession at all, but only a
nutation of Precession.

Prop. 50.

The forces rotating the planets, retarding their rota-
tions and limiting the velocity thereof, and determining
the inclination of the axis of each to the orbit, are similar
to those of our Earth as dealt with in this treatise.

Cor. All the planets possess a cool solid magnetic globe,
an ocean, an atmosphere, electric matter, and in general
a structure resembling our Earth including the eccentric
distribution of land and fluids, and their conditions can
be approximated from the results of telescopic obser-
vation.

Prop. 51.

For equal planetary conditions the forces retarding the
rotation of a planet follow a law resembling that of the
tides viz. vary inversely as the cube of the distance of
the planet from the Sun, while the forces producing
rotation follow the law of radiated light, viz. vary inver-
sely as the square of the distance from the Sun. The
two sets of forces modified by the resulting annual in-
clination limit the period of rotation.

Cor. Other things being equal, the more remote a
planet is from the Sun the faster it will rotate.

298.—Time would fail me to go into all the propositions,
corollaries, inferences, and extensions, which arise from
the discovery of the kinetics of Precession, and of the
electro-magnetic source of the planetary rotations as
manifested by that of the Earth, and I must now confine
myself more immediately to the Tides of the Ocean, and
the Atmospheric Circulation with the view of closing
this treatise.

299.—All theories of the tides which do not recognise

the effects of the eccentricity of the fluids, the air and water of the ocean, and that of the continental or landward protuberance of the globe, are worthless. Without this eccentricity, whatever might be the circulation of the atmosphere and ocean, the semi-diurnal tides of the ocean would cease.
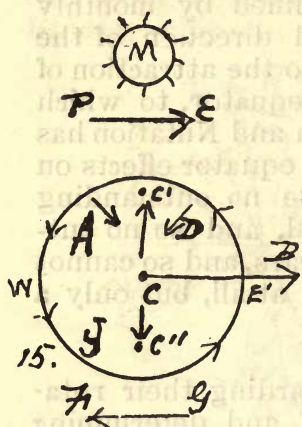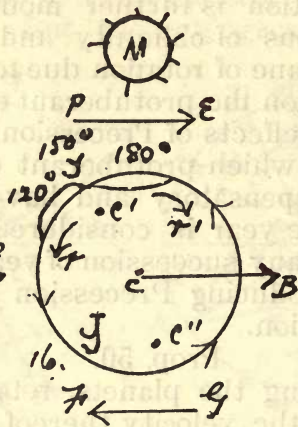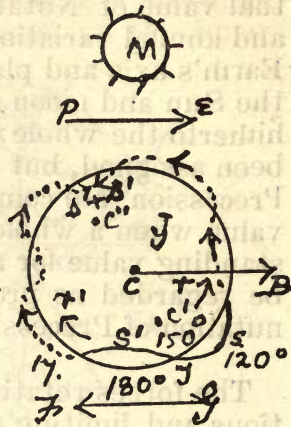
Fig. 15.　　　Fig. 16,　　　Fig. 17.

UNDULATORY or RADIANT THEORY of the TIDES.

300.—The forces producing the tides affect the entire ocean with an en masse movement under the forces, but the tidal effects are segmental with nodes distributed over the ocean, the wave or segmental lengths being determined by the position, form, area, and depth of the sea affected. The principal node is Tahiti. In the various figures 15 to 20, T represents the position of Tahiti. In Fig. 18 Tahiti is shown as the summit of the fluid eccentric. The major mass of this eccentric is water. The orbit of the Earth is indicated by the line C B, as it moves about the luminary M or M$^/$ the Moon or Sun. The centre of gravity of the fluid eccentrie is represented by C$^/$, that of the continental protuberance by C$^{//}$, and during a diurnal rotation whether with respect to the lunar or solar day, that of the Moon or Sun, the distance of C$^/$ and C$^{//}$ from each other is variable, and the oscillation of distance synchronises in pitch or i.e. in period with that of the tides.

301.—We began this treatise by assigning the whole tidal effects to movements of the atmosphere. Its great extent, mobility, and power and weight of the winds, seemed to point to the atmosphere as the tide raiser as did the magnitude of Precessional effects. But we now find that there is a great direct action on the waters, that this is the major action in raising the tides, but that ocean and atmosphere conjoin their forces in what may

be denominated the action and reaction of the fluid eccentric, a term we now use to include both air and water. Further we now take the view that the semi-diurnal barometrical maximum is due chiefly to an oscillation of the atmosphere of compress and rarefaction, i.e. is an atmospheric tide and though it must necessarily affect the level of the ocean and height of the oceanic tides, it does not appear to be a major cause of the tides.
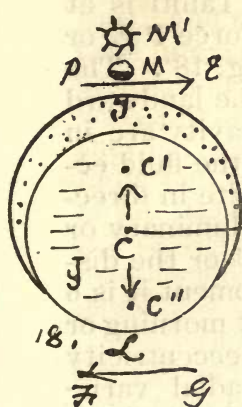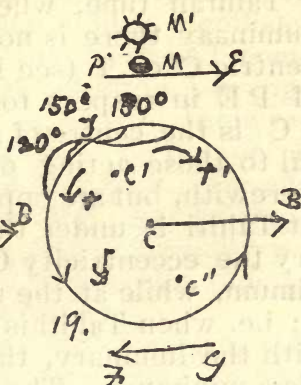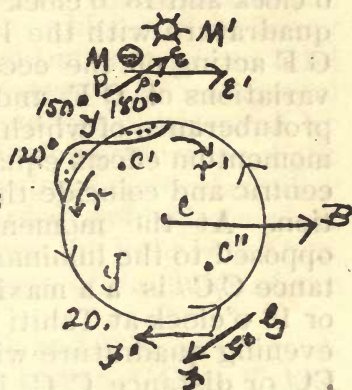
Fig. 18.   Fig. 19.   Fig. 20.

302.—In Fig. 15 let M be the luminary, the Moon or Sun. Let the Earth's diurnal rotation be indicated by the arrowed circle, and let C' the centre of gravity of the fluid eccentric be in the meridian immediately under the luminary. Then the fluid eccentric is impelled by a force P E which causes the fluids to outrun the Earth in the orbit, at the same time that the continental protuberance C'' holds the solid Earth back by a force G F. Thus the ocean waters are removed from the quadrant A into the quadrant D. The inpouring of waters into the quadrant D, increasing the mass and weight of water in this quadrant, developes descending currents, arising from the superior weight of water, while removal of water from the quadrant A, developes ascending currents, arising from hydraulic pressure from below due to the more unmoved parts of the ocean remote from the force P E. The movements A and D represent tidal phase and are oppositely directed. Hence there will always be a difference of half a vibratory period upon opposite sides of C' with respect to east and west. The centre of gravity C' of the fluid eccentric appears to be in a radius of the Earth emergent at Tahiti, and the point of emergence of this radius is at all times a tidal node, and there will always be a difference of phase of

half a vibratory period in the two arcs or half wave
lengths of tide immediately to the east and west of Tahiti.

303.—Referring to Figs. 15 and 16. When Tahiti (T)
is directly under the luminary M at 0 or 24 o'clock Tahitan
time, the force P E acting on the oceanic eccentric C'
is a maximum, and when Tahiti is directly opposite at
12 o'clock Tahitan time the force G F acting on the ec-
centric is a maximum, while on the other hand at 6
o'clock and 18 o'clock Tahitan time, when Tahiti is at
quadrature with the luminaay there is no force P E or
G F acting on the eccentric C' or T (see Fig. 18). The
variations of G F and P E in respect to the landward
protuberance of which C'' is the centre of gravity are in
momentum effects equal to those acting on the fluid ec-
centric and coincide therewith, but are opposite in direc-
tion. At the moment Tahiti is under the luminary or
opposed to the luminary the eccentricity CC' or the dis-
tance C$_i$C'' is a a maximum, while at the moment it is 6
or 18 o'clock at Tahiti ; i.e. when Tahiti is at morning or
evening quadrature with the luminary, the eccentricity
CC' or distance C' C'' is a minimum. The radial varia-
tion CC' of the eccentricity, and the tangential displace-
mentP E,GF of the fluid eccentric the combined displace-
ment at the conjunctions of the eccentric, and return to
the normal position at the quadratures, this reciprocat-
ing movement of the fluid eccentric aud protuberant
solids of the globe, is the cause of the tides Having re
gard to the orbital motion CB, the effect of the forces CC'
and P E is to raise the ocean level over the entire hem-
isphere into which the resultant is directed, and which
may be denominated the Western Polynesian or Old
World hemisphere, and to lower the ocean level over
that from which the resultant is directed, which may be
denominated the Eastern Polynesian or New World
hemisphere, and the withdrawal of the forces C C$_i$ and
P E at the quadratures of C' returns the waters to their
normal level. This is the reciprocating motion of the
ocean arising from its eccentric position and that of the
air resting on it, which gives rise to the tides, a dis-
placement embracing the entire mass of the ocean, and
the displacement of the ocean mass and air and that of
the solid globe by the forces C C',C C'', P E, G F, in which
C of the solid Earth, and C' of the fluids recede from
each other, and move from their normal position at the
conjunction of the eccentric with the luminary is sufficient
when converted into returning momentum and impact at
the approach to the quadrature of the eccentric, to gen-

erate the radiant energy of the tides. Whenever momentum is destroyed by impact, in whatever way, in some form or other radiant energy results, and the tides are but an expression of this law on a gigantic scale. The forces P E, C C′, C C″, G F develope potential of position at the conjunctions of the eccentric with the luminary, when the solid globe and oceanic eccentric are most wide apart, with returning momentum when they approach most nearly together in passing to quadrature, and the momentum destroyed by impact of the Earth and ocean under a collision which occurs every tidal interval, the destroyed momentum appears as tidal undulation and radiation, passing over the ocean as tidal waves, which again have their momentum dispersed by thermal radiation. To pursue analogies further, light radiation itself may be but the effects of molecular tides, or i.e. tides in what may be regarded as fluid oceans of the molecules, more especially when the light is the harmonic spectral bright line radiations of the fluids of the molecules of a hot gas.

304.—Dealing with the force C C′ and P E, and regarding (T) immediately over C on the radius C C′ as Tahiti, the inpouring of water of the ocean into Western Polynesia immediately to the west of Tahiti (T) and its withdrawal from Eastern Polynesia immediately to the east of Tahiti, produces descending and ascending tidal phase immediately to the west and east of Tahiti respectively, culminating as the Earth rotates, in trough and crest in the alternate Polynesian tidal segments, about two hours past the position under consideration, as shown in Fig.16, trough in Western Polynesia, crest in Eastern, the centres of the trough and crest in longitude 180 W. and 120 W. respectively, which crest and trough occurring at about 2 o'clock Tahiti time are primary tidal waves of the globe, in the phase indicated, of which Tahiti is the node, the former or Western Polynesian segmental undulation radiating westwards and polewards, the latter or Eastern Polynesian segmental undulation radiating eastwards and polewards, but neither wave radiates directly across the Tahitian node, but which latter is at all times and every moment a node both in respect to the lunar and solar primary tides, and the two segmental undulations, the lunar, each cover an arc of about 60°upon opposite sides of Tahiti in respect to east to west, and these two undulations at all times differ in phase by half a vibratory period.

305.—Referring to Fig. 16. This fig. is taken as at

2 o'clock Tahitian time. At about 2 o'clock Tahitian time the primary tide in ebb phase of the Polynesian Ocean may be said to be established, whether we regard the tide of conjunction or opposition, i.e. the day or night tide, both of which are similarly produced. It is then slack water on the Polynesian trough on the meridian of 180° at 0 or 24 o'clock local time of this meridian, and slack water on the Eastern Polynesian crest in longitude 120° W. at 4 o'clock local time of this meridian, a potentiality of position occurring at 2 o'clock Tahiti time, and adapted to radiate the tides in directious moving away from the Tahitian node to all parts of the ocean, and the Tahitian node T, at Tahiti in longitude 150,° and immediately above the centre of gravity of the fluid eccentric C', may be regarded as the radiant source of all the tidal waves of the globe, or the point C' directly under Tahiti may be regarded as their radiant point. The height and position of all other tidal waves will be determined in proper radiant sequence by the amplitude and position of the Polynesian, the paths their radiations take, and the areas and depth of ocean transited by the waves, modified by effects of superposition and interference, segmental, nodal, and phase superposition in the two lunar or two solar tidal rays, the east and west going of each luminary and also superposition of segments, nodes, and phases of the lunar and solar tidal waves, as these meet, cross, and overlap each other, varied by dimensional differences, and differences of radiant velocity, between the lunar and solar tidal waves.

306.—The pitch of the semi-diurnal lunar tides is a complete to and fro vibration effected twice per lunar day, and for solar tides effected twice per solar day, thus the two pitches agree so nearly in period, that large effects of superposition and interference arise from the overlap of the two systems.

307.—Apart from effects of superposition and interference the two systems of tidal waves, the lunar and solar, may be regarded as independent of each other.

308.—As the pitch of the tide for the Moon or Sun, synchronises with the period of action of the forces producing it, i.e. the alternations of CC', PE, and CC'' GF, the pitch or phase produced by successive conjunctions of the luminary with the eccentric raises a sequence of tides which are mutually strengthening and sustaining, in respect to the tides of the given luminary.

309.—We have shown the position of the primary

tides of the ocean, i.e. about Tahiti, radiating from Tahiti in the directions r and r',Figs. 15 to 20, we are not called upon to show the positions of all the tidal waves of the ocean as these are successively transmitted over the entire mass, this can only be done by observations and careful charting, but approximately there results from lunar action four crests and four troughs in a belt of longitude passing eastwards and westwards from Tahiti to the southern side of the Atlantic, in a distribution of crest and trough resembling the waved curve of Fig.17, the radiations from Tahiti (T) meeting at s and s/ (the southern side of the Atlantic) under conditions of like phase, as shown by the arrowed movement, r and r/ and resulting at the south side of the Atlantic s and s/ in a wave of double amplitude, a superposition and combination which greatly enhances the tides of the Atlantic as compared with those of the Pacific, as the superposed waves radiate np the Atlantic to its northernmost limits. Any regions of very low tides in the Atlantic, constantly low, are segmental wave nodes, the regions of the great-est tides, segmental wave centres.

310.—Only where the nodes coincide in respect to both lunar and solar segments are tides actually absent. Such a segmental node is Tahiti on the primary tide, but there may be subsidiary segmental nodes of second-ary character, and observations appear to indicate that there are such.

311.—The constancy of position of the Tahitian node indicates that the tides are not due simply to the wanderings of the Moon and Sun over the ocean carry-ing the effects from position to position, with like effects for successive positions, but to these movements as they affect something of fixed position indicated by the sta-tionary position of the Tahitian node, and this thing of fixed position is the oceanic eccentric or its centre of gravity C', whose oscillations whatever be the position of the luminary are always to and fro about the radius C T or the centre of gravity C/, and over a small path.

312.—The tidal energy measured by dimensions and amplitude of the tidal waves taken together, varies in-versely as the square of the distance from the source, hence the greatest and least tides occur when the Poly-nesian waves of the first order in respect to the Moon and Sun are centrally superposed to the east and west of Tahiti, in like phase in respect to the tides of the con-junctions as shown in Fig. 20, and similarly superposed but differing in phase by half a vibratory period at the

quadratures in Fig. 20, the dotted crest and trough represents the solar primary title of Polynesia. These superpositions in Polynesia occur about two days after new and full Moon in respect to spring tides, and about two days after the quadratures in respect to neap effects. The earlier superpositions being always the greater along the course of the tidal waves as they radiate from Polynesia, it follows that the whole ocean reflects generally the condition of Polynesia, but with segmental variations of effect giving local departures from the general rule that the tides are highest about two days after the conjunctions and least about two days after the quadratures. Hence most places will have their spring tides about two days after the conjunctions, and neap tides two days after the quadratures, but there will be local departures from this general rule. Compare Figs.19 & 20.

313.—The physics of the tides should be referred to Tahiti time.

314.—Just as the semi-diurnal or tides proper are produced by the action of the Moon and Sun on the oceanic eccentric, so the diurnal inequality is produced by these luminaries acting on the protuberant equator of the ocean, i.e. the tides proper are produced by gravitation of the Moon and Sun acting on what may be denominated the right ascensional or longitudinal eccentric, while the diurnal inequality is produced by gravitation of the luminary acting on what may be denominated the rotational, meridional, or latitudinal eccentricity of the fluids of the ocean, the protuberance of the fluids produced by the centrifugal force of the Earth's rotation accentuated by the geographical, longitudinal, or right ascensional eccentricity.

315.—The fluids of the ocean, as the result of the centrifugal equatorial protuberance, acted on by gravitation of the luminary, are alternately thrown from the northern geographical or celestial hemisphere of the globe into the southern and vice versa, at intervals of 12 hours, giving one complete to and fro meridional oscillation in 24 hours, and this 24-hour meridional tide, superposed upon the 12-hour longitudinal tide, is the cause of the diurnal inequality of the latter, an inequality which vanishes when the Sun and Moon are both situated in the plane of the equatorial protuberance.

316.—Referring to Figs. 21 and 22 let T be the summit of the oceanic eccentric, and of the equatorial protuberance, the combined summit of the two eccentricities appearing to be in the longitude of Tahiti in cen-

tral Polynesia. Then when it is 0 or 24 o'clock day time at the summit in respect to the luminary, the Moon or Sun, and the luminary is situated in declination removed from the protuberance and eccentric, as shown in Fig. 21, then the luminary is by gravitation pulling the fluids in the direction R B and pouring water out of the northern hemisphere directly into the southern, and setting up the ascending and descending potentials of tidal movement A and D in the respective hemispheres, while 12 hours later as shown in Fig. 22 the reverse occurs and the solid globe being now pulled in the direction in which the fluids were previously pulled,thus is set up a 24-hour meridional tidal oscillation or wave of which a point near Tahiti is the node, but which meridional oscillation moves round the Pacific following the course of the Moon and Sun as the luminary rises and sets in its daily march, in a manner resembling that which has heretofore been assigned to the ordinary tides, and the superposition of the 24-hour meridional tide upon the 12-hour ordinary tides, is the cause of the diurnal inequality. If on the morning semi-diurnal tide the superposition of the diurnal meridional tide is in like phase with the former ordinary tides, say phase A of Fig. 21, then on the evening tide the superposition is in opposed phase. These effects are specially shown ,in the Eastern Archipelago, and in the Anamba Islands, where the interference between the two tides the ordinary and meridional is alternately one of double phase and opposed phase, and the resulting tide alternately the sum and difference of the two, the semidiurnal and diurnal, so that when the Sun is near the solstice,then in these regions there is only one tide in the 24 hours,though when at the equinoxes there are two.

317.—The diurnal inequality being due to a 24-hour meridional tide of the equatorial rotational protuberance accentuated by the longitudinal eccentric, all in the manuer indicated, we have in its effects on the semi-diurnal ordinary tides the means of estimating every condition of phase and phase production on the tides of every region, as these are affected by the different positions of the Moon and Sun.

318.—We are now in a position to show in one graphic view Fig. 23 a simple, concise, and rational view of the tides, that is of the ordinary oceanic tides, the semi-diurnal tides, without reference to the protuberant equator force and diurnal inequality tides, and without reference to the motions of the tides as they are affected by atmospheric and wind movements, and only in order that

the tides may be embodied to the ordinary reader in as
simple a form as that of any hitherto given, but with
this proviso, that the figure only comprehends the main
features, and provides the base of a working theory,
around which may be built every detail of the whole
phenomena of the tides. The forces which give rise to
the ordinary tides are six, subtending successively the
arcs occupied by the oceanic eccentric as it is rotated
round the globe, viz. A B, P E, D H, K L, G F, M N. In
their entirety they may be viewed as four alternations of
east to west and west to east forces, acting on the eccen-
tric. As C$'$ the centre of gravity of the oceanic eccentric
is rotated under G F, M N, it moves westward out of the
radius CT$'$ and the waters are moved westward out of
Eastern Polynesia into Western Polynesia and at 8 a.m.
Tahiti time, the waters have developed a trough O and a
crest R to the east and west respectively of Tahiti (T.)
This trough and crest is the primary tide of the ocean as
at trough phase in Eastern Polynesia and crest phase in
Western Polynesia, and its radiations give rise to all the
tides of the globe. As the centre of gravity C$'$ of the ec-
centric rotates under the force AB, the waters now acted
on by the west to east force AB, the crest R falls, at the
same time that by its pressure and the momentum of its
fall, it radiates westwards across the ocean. The trough
O also fills under the effects of the force A'B and while
filling radiates its phase eastwards and along the western
coasts of America northwards and southwards and north-
wards and southwards over the Pacific. When we know
the hour and positions of the crest and trough R and O,
the tides and the positions of all the other crests and
troughs of the ocean are determined by the wave lengths,
which again are determined by the velocity of radiation.
At about 6 a.m. Tahitian time the primary tide of West-
ern Polynesia R is flowing fastest, and the primary tide of
Eastern Polynesia O is ebbing fastest but at 8 a.m. Tahiti
time it is slack water on both the primary tides, the
Eastern Polynesian trough O being now deepest, and
the Western Polynesian crest R highest, and what
may be denominated the radiant potential is a maximum
about T, in the tidal waves R and O. The forces G F,
M N, A B, and all the forces of the Figure act in the
plane of the ecliptic. The action of P E, D H, K L, is
similar to that of G F, M N, A B, but twelve hours later.
Thus if we take R as a position in Western Polynesia
in longitude 180° W. in the plane of the ecliptic, with the
Sun and Moon in New Moon conjunction at the time of

an equinox, then at 6 a.m. local time it is flow at R, at 12 noon it is ebb at R, again at 6 p.m. it is flow at R, and at 12 midnight it is ebb at R, by the operation of the forces of the Figure. The crest phase at the Galapagos in 90° W. coincides and synchronises with that at R 180 W., though the Galapagos is receiving its tidal phase by radiation from O. Amid all these vibrations, undulations, or oscillations of the ocean in Polynesia, the Tahitian sea is a stationary node, and Tahiti immediately above the centre of gravity of the eccentric C/, though itself the node, may be regarded in terms of an undulatory theory of the tides, as the radiant-point-source of the tidal waves.

319.—On the withdrawal of the force GF, MN, at 6 a.m. Tahiti time, and the passage of Tahiti under the force AB, the centre of gravity C/ of the oceanic eccentric ceases its east to west excursion, and returns back into C T, and passes to the eastern side of C T. Hence the oscilations of the ocean giving rise to the tides may be expressed in those of the centre of gravity C/ of the oceanic eccentric. The effects are similar when C/ is carried round into the night hemisphere of the globe. Thus C/ effects a complete to and fro oscillation every 12 lunar hours, from ecliptic east to ecliptic west, and vice versa, or i.e. two complete oscillations per tidal day.

320.—With the luminary at the solstice or in high declination north or south, there is an ascending and descending component of tidal throw producing a diurnal inequality, in respect to the a.m. and p.m. tides.

321.—The force M N, G F, outweighs the force A B, and the force P E, H D, outweighs the force K L, hence the Western Polynesian tides R, outweigh the Eastern Polynesian tides O. and the balance of impulse or momentum effected on the whole Earth is a Precessional effect or rotation in the plane and direction MN, GF, DH, P E. Thus the forces M N and D H have to be added to those of P E and G F in the production of Precessional and Nutational effects, but modified by A B and K L.

322.—The force A B is centripetal force of gravitation acting on the mass of the ocean or eccentric directed towards the luminary, the force P E is orbital force already fully considered, the force D H is centripetal force on the eccentric C/ directed towards the luminary, the force K L is centrifugal force from the luminary, the force G F is orbital force already fully considered, the force MN is centrifugal force directed from the luminary, and only at the quadratures of C/ with the luminary do

all these forces cease to act on the eccentric C/ at which moment tidal force is only potential as wave phase, and displacement of ocean level.

323.—Perhaps every consideration advanced in this treatise has some weight with reference to tidal production and tidal inequalities, but the main cause of the tides, and without which they would practically cease to exist, is the eccentric and protuberant position of the ocean waters, and the throw of the eccentric CC/, that throw of the ocean fluids which conjoined with the throw of the atmosphere and its ecliptic east to ecliptic west circulation, gives rise to Precession of the Equinoxes, Nutation, and Secular Retardation, but of which, Secular Retardation is prevented from acting by the electric discharge taking place on the globe, which latter acts to rotate the globe with a force about equal to the retarding forces of the Precessional and Tidal movements.

324.—In proportion as the electric rotation of the globe acts through surface electric discharge affecting the atmosphere and ocean, and that about the higher latitudes and magnetic poles, to this extent it developes west to east winds and currents and variable tension movements of the atmosphere in this direction in the higher latitudes, a movement aiding to develope storms and convey these across the Atlantic from west to east.

335.—Thus Precessional-Secular-Retardation on the atmosphere is directed from east to west in the tropics, Electro-magnetic Rotational Acceleration on the atmosphere is directed from west to east in the higher latitudes, and the two systems of movement coming in contact in the circles of Capricorn and Cancer develope calm in these regions.

326.—Thus from what has gone before, it appears that the calms of the equator are due to descending currents on a low tension system of air movement embracing the entire atmosphere, as illustrated in Fig. 24, the calms of the tropics to the meeting of the lower meridional pole-going and upper equator going currents of this system, and also to the Precessional, Retardational, and Electro-Magnetic Rotational currents directed respectively from east to west, and west to east, of which the east to west or Precessional-Retardational air movements prevail in the tropics, and the west to east or Electro-Magnetic Rotational air movements prevail in the higher latitudes and latitudes of the magnetic poles.

327.—Any view of the Tides of the Ocean, and move-

ments of the air which does not take into account elec-
tro-magnetic forces is incomplete, but gravitational con-
siderations are the chief considerations.
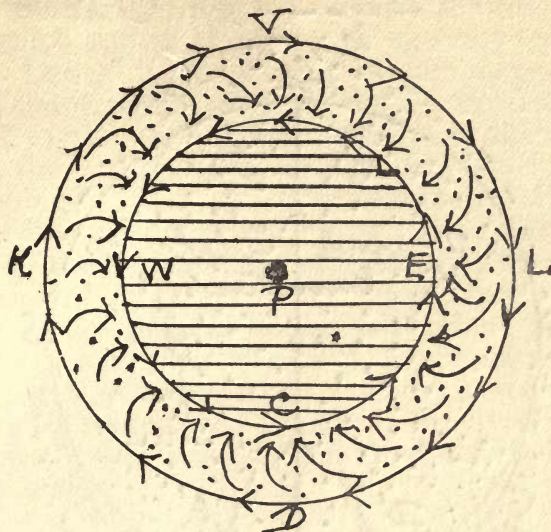
Fig. 5, showing circulation of the air at the
equator, viz., that of descending currents.
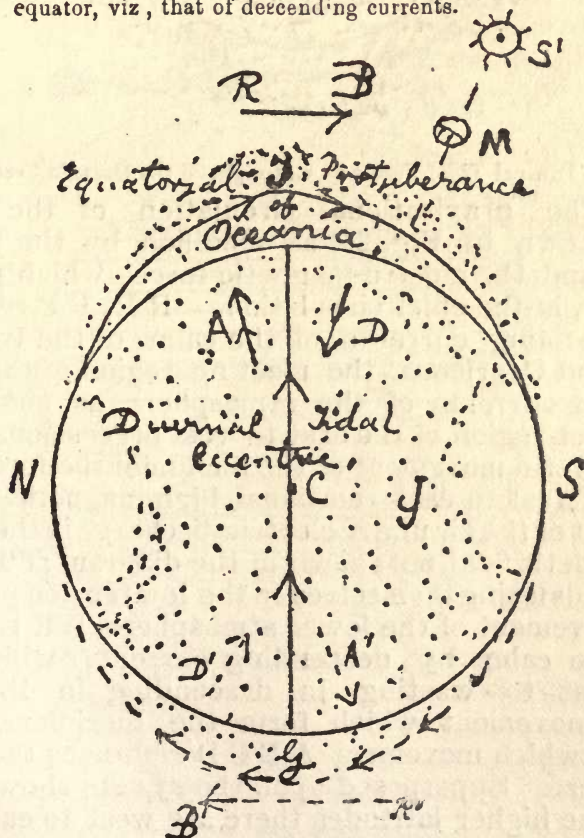
Fig. 21. Diurnal Tidal Forces, at mid-day of the Eccentric.
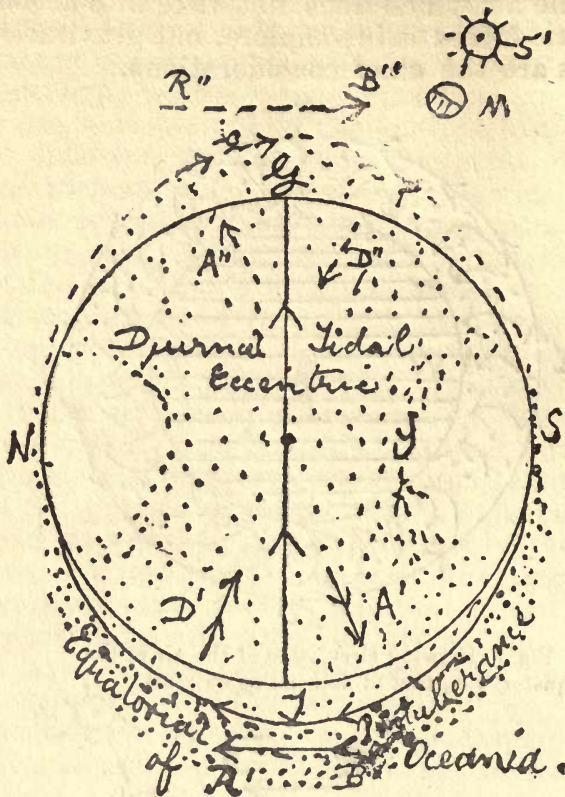
Fig. 22. Diurnal Tidal Forces at mid-night of the Oceanic Eccentric.

328.—The gravitational circulation of the atmosphere, shown in Fig. 24, as modified by the Earth's rotation and the electro-magnetic forces which produce the latter, is the chief circulation. R R, P P represent the descending currents of the calms of the tropics of Cancer and Capricorn, the meeting region of the upper and lower currents of the atmosphere as shown and the contact region of the east to west precessional, equatorial, ecliptic movement of the air under the forces P E, G F, and west to east rotational high-magnetic-latitude movement of the air under electric discharge in the terrestrial magnetic field, not shown in the diagram ;T TTT the trade winds losing themselves in the low tension poleward going movement of the lower atmosphere, WE the equator made calm by descending currents which lose their east - to - westing in descending in the low tension movement which form the meridional loops A B C D, which movement A B C D embraces the entire atmosphere. Superposed upon the system shown in the Fig. in the higher latitudes there are west to east going

air currents and movement of low tension but great
depth, due to electric discharge in the Earth's magnetic
field acted on by terrestrial magnetism, and serving to
maintain the Earth's rotation against the forces of Pre-
cession which acting alone would speedily remove the
rotation. Under these effects of electro-magnetic action
in our latitudes, storm centres almost invariably move
from west to east, and when there are brilliant displays
of aurora, the auroral arch visibly manifests in its west
to east rolling clouds, the electro-magnetic forces which
rotate the Earth, and act to move the air from west to
east. In all the atmospheric circulation of the nature of
wind or violent movement thermal convection appears
to play no direct part, although when long periods are
taken it may have some effects of air displacement, but
the latter even when seasonal variations are taken into
account, must be referred chiefly to gravitational forces
as dealt with in this treatise, including a a a a, Fig.24,the
anti-trade winds.   * M
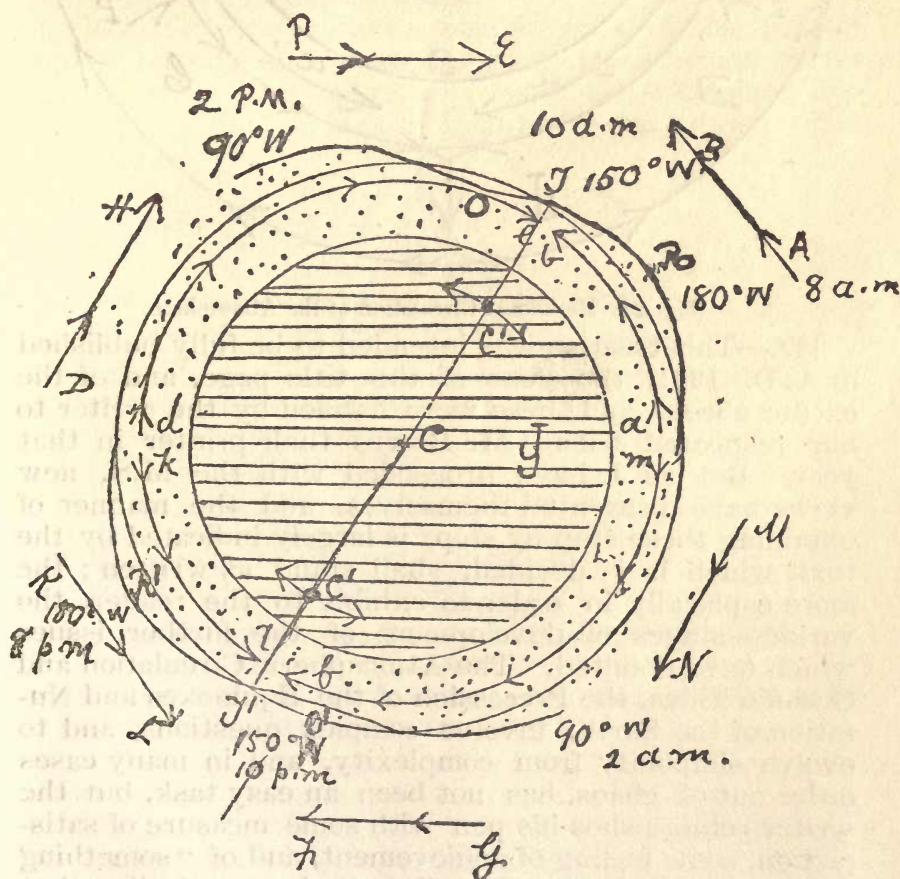
Fig. 23. The Tidal Forces.
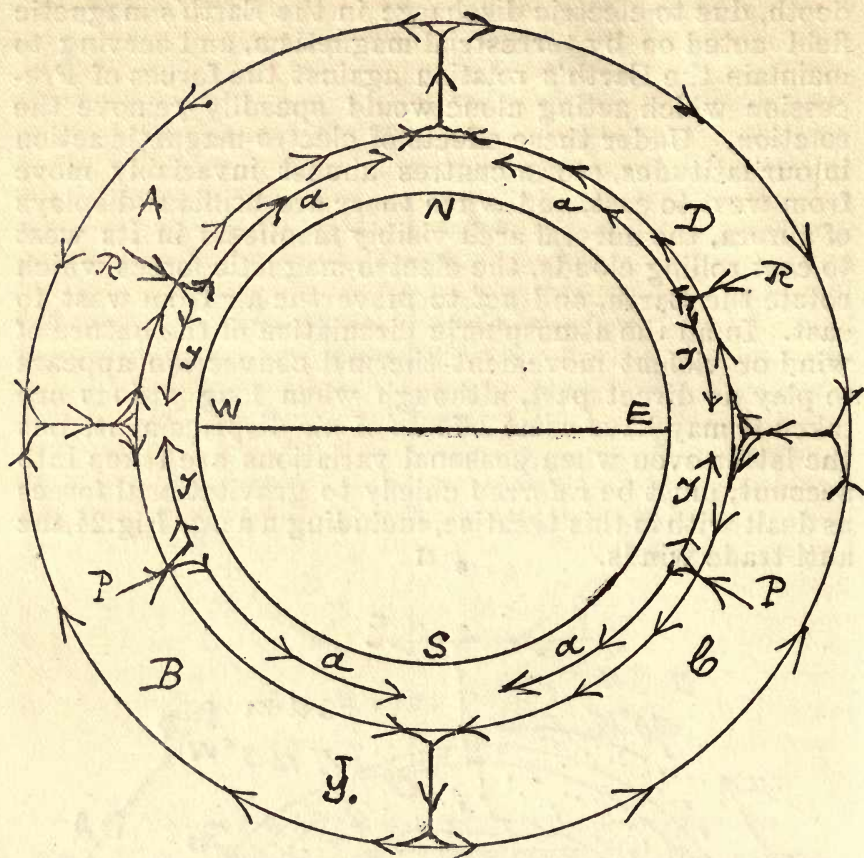
Fig 24. Meridional Circulation of the Atmosphere.

329.—This treatise was intended to be fully published in A. D. 1901, the year of the title page, and of the earlier sheets, and these were handed by the writer to our respected friend Mr Bowes their printer in that year. But as I have proceeded with the M.S. new views have presented themselves, and the manner of obtaining these step by step, is largely indicated by the text, which it is decided, shall stand as written ; the more especially in order to exhibit to the reader, the various stages of development of the further issues which have resulted. The Atmospheric Circulation and Oceanic Tides, the Precession of the Equinoxes and Nutation of the Earth, involve complex questions, and to evolve simplicity from complexity, and in many cases order out of chaos, has not been an easy task, but the writer relinquishes his pen with some measure of satisfaction, some feeling of achievement, and of "something attempted, something done," but also the feeling that

had he known the perplexing and dimensional character of the task placed before him, when setting out, he would have shrunk from it in dismay, but having put his hand to the plough, the author could not turn back until he had accomplished a large portion of the work set before himself, and such he adjudges, as shall change the whole field of Natural Science, and prepare the way for a new crop of developments. From the abstruse and recondite character of the subjects and questions involved, however important they may be, the writer can scarcely hope to reach a large audience during his lifetime, but as Pythagoras had to speak for hundreds of years before he was heard, and Copernicus and Galileo had also to die before their confirmatory words and discoveries could prevail, so the writer of this treatise will rest content even though his discoveries as revealed in this treatise should not receive a better fate than did those of the trio just named, but he also hopes, that they may receive at least no worse.

330.—With the author's compliments to the printer and all friends, and good wishes that a new and better era in which knowledge may have its true place, dispersing the dark clouds of ignorance—may dawn upon the world.

<div align="center">FINIS.</div>

Christmas, 1902.

<div align="center">ERRATA.</div>

DEDICATION, line 10, for justifition read justification.
P. 23, line 5, for westward read eastward.
P. 27, s 114, line 3, for 5_0 read 5°.
P. 31, s 125, line 6, for treatine read treatise.
P. 36, Tables, See Errata to Tables on p. 43.
P. 37, line 31, for onter read outer.
P. 45-46, see Note at foot of Errata.
P. 55, s 167, line 2, for .53 read 5.3
P. 69, s 205, line 2, for bed read level.
P. 72, s 213, line 7, for hy read by.
P. 79, line 21, for 2 o'clock, read 8 o'clock.
P. 87, line 10, for evcept read except.

<div align="center">NOTE 1.</div>

P. 45, s 146, for Fig. 6, take the left hand diagram of Fig. 3, p. 61.

<div align="center">NOTE 2.</div>

There are a number of minor mistakes which being immaterial to the arguments are allowed to remain uncorrected.

INDEX

WITH

COROLLARIES AND ADDENDA.

tion of position in the Earth, rotating in this period round the centre of form s 142 and context.

CENTRE OF GRAVITY of the ocean is eccentrically situated in the globe s 268 and context. Is subject to oscillation in the tidal intervals s 311—315 and context. Its mean position is under Tahiti s 302 and context. Its movements express the semi-diurnal and diurnal tidal forces or motions s 302—322 and context.

CENTRIFUOAL eccentricity of the ocean by the Earth's rotation, or its protuberance on the equator, aided by its meridional geographical eccentricity, acted on by gravitation of the Moon and Sun, is the cause of the diurnal tides s 315—317.

CCMETS owe their shape to electromagnetic induction by solar magnetism. Cor to s 283.

COMPRESS of air and ocean by tidal forces, s 186 and context.

CONFLICT and change, the law of the atmosphere and weather. s 2—330

CONTINENTAL dams, and the tides, s 270 and context.

CONVECTION. Thermal convection simplicity is not the law of the atmospheric movements. s 1—12

COSMICAL source of winds s 1.

CRATER. No volcanic craters in the Moon, s 142, p. 38

CURRENTS of the ocean are directed from ecliptic east to ecliptic west in the tropics producing Secular Retardation, and Precession, are pole-going currents on the eastern or windward side of continents ; and equator going currents on the western or leeward side of continents. s 1—330.

CURRENTS of the Atmosphere, are a descending current of air over the whole of the equator and tropics, a pole going movement of air in the entire lower strata, a movement towards the equator in the entire upper strata. together forming the low tension system of Atmospheric Circulation, with secondary descending currents in the circles of Cancer and Capricorn producing the pressure which gives rise to the trade winds and anti-trades the two latter a high tension system only affecting

the base of the atmosphere and losing itself by impact and friction in the great low tension loop system of Fig.24, p.132. These low tension and high tension systems are both modified by that of the electro-magnetic deflection s 325 and context, and also by the east to west force of P E, G F, and meridional force of A B, D H, K L, M N, Fig. 23.

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DESCENDING air of Equator, Tropics, Cancer and Capricorn, s 187, and context.

DESIGN and Creation the law of the Universe, not growth and evolution. s 142 and context.

DIRECT action of Moon and Sun on the ocean waters to raise a tide, s 301.

DIURNAL rotation of the Earth produced and maintained by electric discharge in the terrestrial magnetic field, s 290.

DIURNAL tides, are due to eccentric positions of the ocean basins, and the equatorial protuberance of water arising from the Earth's rotation, acted on by the Moon and Sun, and to the greatest degree when these bodies are at the solstices, and i.e., to the same forces which acting on the protuberant air of the equator and oceanic basins, produce the Monsoons, the diurnal tides and the Monsoons having a similar half-yearly variation of force and direction, s 314 and context.

DOLDRUMS, are calms and humidity due to descending air, s 326& context

DYNAMO, the Sun is an electro-magnetic dynamo in an arrangement of ordinary ponderable matter.s 142

EARTH is subject to forces which remove rotation, s 55—155, which impart rotation, s 285—267, and context, and from season to season loss and gain are alternating by small fractions, but the mean value remains practically constant. Telescopic observations of transits appear to show the variationsunder the Tidal forces,and by the forces of

orbit, the Motion of the Apsides, Evection, Variation, and Annual Equation, and act in the contrary direction to that of the action to which these variations are usually assigned. In the second and fourth quadrants of the orbit PE, GF act to elongate the radius vector, in the first and third quadrants they act to contract the radius vestor, according as the forces are carrying the Moon and Earth to a point without or within the mean orbit. From quadrature to conjunction PE, GF are directed outwards and act to expand the orbit and elongate its radius-vector-diameter from conjunction to quadrature PE, GF are directed inwards and act to contract the orbit and shorten its radius-vector-diameter at the quadratures, all in accordance with tabled observations. The reader can easily construct a figure to illustrate this, or deduce it from the various Figures of this treatise.

FUNDAMENTAL view of the Tides s 198
FIGURES. Fig. 1 p. 44, 2 p. 47,3 p.61 4 p. 64, 5, 6, p. 61, 7, 8, 9,10, p.91 11, 12, p. 115, 13, 14, p. 116, 15, 16, 17, p. 118, 18, 19, 20, p. 119, 21, p 22, p. 23, p. 24, p. 25, p.
GALAPAGOS. Two tides originate in Eastern Polynesia and entering the Galapagos radiate polewards and eastwards, s 233 and context.
GENEALOGY of John Jones, Author of this Treatise, s 142, p. 42.
AUTOBIOGRAPHY of author,see Addenda.
GF. and PE, orbital forces, Figs. 1 7, 8, 9, 10, 15, 16, 17, 18, 19, 20,and context.
GLACIERS, are the fountains of the deep spoken of by Moses in the account of the Flood, s 142.
GRAVITATION is an induced and variable force resembling magnetism, and variable according to location of mass with respect to other masses, s 142 and context. Is not a "feeble force" as commonly supposed but the Giant of the Universe in strength, and the source of all ponderable manifestations of energy, s 172, Cor. Cohesion is a variable force, and for a given density of matter is greatest in the greatest globes or masses.

GYRATION. Rotations and gyrations of elementary matter, the cause of gravitation, s 142 and context. Cor (a) The smallest gravitational unit, practically a mathematical point of matter, contains an energy of rotation whose kinetic value exceeds that of the motion of the stars in their courses. The interlocked rings of matter of a single molecule contain an energy practically infinite. The ultimate constitution of matter is that of absolutely rigid and indestructible interlocked rings, rotating on their space axes with a velocity which is practically infinite. [We use the word infinite because it covers the quantity of energy, but as a matter of fact, the energy possesses limits, but only in the sense that the universe may possess limits, and doubtless does. Beyond this universe the Great Creator may have many Universes, not constructed of matter as we know it, but entirely different to this, and doubtless has such, but with these we have no immediate concern. By matter the author of course includes the ether or ethers of space, and the two kinds of matter whose dissociation produces the opposite electricities ; as well as that most cognisant to our senses. However deep we may dip it is the author's wish only to deal with what may be brought under the domain of observation for the purposes of practical utility in life, and elevation of mind.]
Cor. (c) The manifestations of force or motion generally have arisen and do arise from the elementary rotations and gyrations.
Cor. (d) The arrangements of the interlocking of the elementary matter determine the size and form of molecules.
Cor. (e) Molecules are bubbles of matter whose walls cohere by contact, and whose intermural interstices contain illimitable motions and energies. The manifestions of force indicate the character of these energies. The sides of the bubbles are very elastic. The elasticity differs for different substances and modifications. In relation to elasticity this Cor. may be regarded as

a bubble theory of the chemical units, although there are subdivisions if we could analyse to further simplicity, which would reduce the number of chemical elements, at the same time that it extended the powers of synthesis.

Cor. (f) A great central force of gravity, the chemical bond as it were, is found at the point of contact of the units of two bubbles, together forming one Dalton unit of the substance, and towards which force of cohesion both bubbles contribute. This cohesion is due to gyrational bombardment in which the matter of each wall seeks to pierce that of the other, but cannot break away from its own interlockings. Subdivision and analysis of the molecular bubbles to obtain more elementary bubbles must be the great aim of chemistry. The atomic theory must go, even if we retain its nomenclature and results with respect to equivalence and multiple proportions. We have not reached the atom, and never shall unless to the mind : As well may we expect to see the most distant star, and comprehend the universe, and weigh it in a balance. Finality may be our aim but it can never be attained, and the expectation of a perfect simplicity (see s 279) must go for ever. "Art is long and life is short" must ever be our experience.

Cor. (g) Gravitational gyrations of matter radiate their bombardments through space from mass to mass, and gravitational unit to unit, in a manner not unlike the radiations of wave motion, and which gravitational radiations may in part partake of wave motion, hence the law that velocity of fall varies as the square of the distance from the attracting body. Necessarily the density of the compressible gravitating units is greatest at the centres of force, but the variations of density may affect the ether rather than ponderable matter, though both must be affected in so far as ponderable matter can yield to the compress, but the greatest range of compressibility appears to be possessed by the ether, though even it may

have its limits in fluidity and solidity, as manifested at the centres of a mass. The condensations of ball lightning appear to indicate that the ether can acquire a fluid or solid state, in a manner resembling the liquifactions and solidifying ot air and other gases.

HARMONY. The greatest manifestation of force in the universe, including the movements of the stars in their courses, are octavely harmonious, with Doh-me-soh and other chords, because light and sound are identical, light being the transverse vibrations of sound, and sound being the longitudinal vibrations of light, and both sets of vibrations always present in a wave of either, and because harmonious octaval manifestions of motion or force possess the greatest power of combination and persistence under superposition, and therefore outweigh all others and possess the greatest longevity. Thunder is a note or sound of such superpositions, and regarding light and sound as identical, the thunderstorms of the Earth and Universe with the accompanying lightning may be regarded as "the music of the spheres." Cor. s 1 to 330.

HORACE and the winds, s 92.

HURRICANES, how caused, s 104 and context.

HEAT and light of the Sun radiates to our Earth the energies of terrestrial rotation, winds, and tides, but the three latter are not due to thermal convection, but to gravitation and electro magnetism in the manner shown in this treatise, and thermal convection plays directly an inappreciable part in the Atmospheric winds and in the currents of the ocean. s 53,283,288, context & cors.

ICE AGE, caused by rings of water formerly round the Earth, resembling those of Saturn, s 142 and cor. The intermediate ring of greatest mass probably locked up the entire waters of the globe as ice, placed the ice over the continents, produced universal darkness over the globe, and destroyed all life upon the globe. This was the condition of the globe immediately preced ing the creation recorded in

Gen. ch. 1, and from which chaotic condition that creation delivered it. The last of the added rings, was of less magnitude, and only partially destroyed the life of the globe, and terminated in the flood of Noah. The Zodiacal Light, appears to be a ring of hydrogen round the globe, the last of the rings,and whose inevitable descent upon the surface of the Earth will probably enwrap it in fire, and again destroy all life from the globe. This event may come at any moment. Indications have been present in the Zodiacal Light to show that it has already made contact with the external limits of our atmosphere.

Impact of the Atmosphere and Ocean against the solid Earth, orbital, and in respect to the diurnal rotation, produces the tides, s 271—330, and context.

Inclination of the Earth's equator to the Ecliptic, is determined and produced by those forces which give rise to Precession, Secular Retardation, Nutation, the Atmospheric Circulation, and the Tides, s 278 and context.

Infinite. The power of rotation and gyration in the elements, illimitable in greatness as actually existing. s 142 and Cor.

Interlude. s 125—142. Deluded followers of unscrupulous statesmen and legislators, s 128, of interested politicians, and bloodsucking brewers, distillers, and murdering publicans, s 129, of priestly ignorance, s 130, of the Pope, s 131, of pseudo-scientific creeds and dogmas, s 132 —134.

Justification. Read justification for justifition. Dedication p. 3. line 11.

Kepler,his profound intuitions, s 139

Kinetic. The forces of Precession, Secular Retardation, Nutation, Atmospheric Circulation,and the Tides, are kinetic movements of the fluids of the ocean, air, and the solid Earth, modified by electro-magnetic forces, s 278, Prop. 1, Cor. 9, and context.

Kinetic theory of matter, s 227—274 and context.

Kinetic theory of force s 227 and context.

Laws of electricity and magnetism, are those of gravitation including cohesion, s 171 and context.

Light and Heat of the Sun are produced in the solar orb by mechanical movements ef aggregated ponderable matter, whose two or more aggregations are moved in opposite directions with reciprocating or alternating motion s 293, Prop. 43, and context. The mechanical movements in the Sun are those of magnetised matter, or matter largely magnetised, and such as to constitute the Sun an electro-magnetic dynamo, s 293, Prop. 44—46, and context. These discoveries and views may be denominated *The Mechanical or Gravitational Theory of Solar Energy and Radiation*, or the *Electro Dynamo Theory of the Sun*, the reciprocating movements beneath the photosphere of the Sun and comprehending the entire mass including the photosphere, being produced by gravitation, acting on potential of position of the two or more aggregated masses. The two masses or chief masses reciprocate in a period of time 1. 1 second of ordinary solar time of the terrestrial tropical day, or i.e. 1. 1 second of any ordinary clock or watch.

Livy and the weather, s 92.

Longitudinally, the tides near the tropics are quadrantly distributed, and not diametrically or oppositely as heretofore regarded, s 247 and context.

Luther, his great doctrine in Dedication p. 3. Read justification for justifition, line 11

Magnet. The Sun a powerful magnet s 142, Cor. Comet tails are developed by electro-magnetic induction of the Sun acting on the moving conducting mass of the comet. Interaction of the developed electric currents in the comet producing gyrational bombardment and magnetic attraction of the electric units retains the comet tail from going to pieces. Centrifugal force in the orbit sometimes overcomes the internal electro-magnetic cohesion of the comet and the comet breaks into two or more parts. Not on account of its mass, but on account of its

electric discharge, collision of the globe and an electrically moving comet would be a serious matter, but in approaching the globe there is repulsion by induction between the globe and comet so that collision is probably rendered impossible, unless the cometary matter first lose its coherence, or becomes broken up into very small meteorites with almost circular orbits about the Sun. In this connection the Earth's selection of cosmic matter will be preferentially for that which moves in orbits about the Sun which are approximately circular, and possess a minimum induction by solar magnetism. Thus if the Earth and planets have grown or do grow by addition of matter from cosmic space, this addition tends to remove any eccentricity of orbit on the part of the globe about the Sun, or to retain the orbits approximately circular. Of course the writer regards the planets as having been projected from the Sun, and in the course of time as returning to collision with the Sun, to be projected again and created anew in respect to the major portion of their mass. The solar system of planets appears to have been formed by two such projections at separate epochs.

MAGNETISM. Its relation to gravitation. s 171 and context.

MAGNETISATION of stellar and solar light in the terrestrial atmosphere producing double refraction thereof, with superposition and interference between the resulting rays is the source of stellar and solar scintillation. s 142 and Cor.

MERIDIAN. Meridional eccentricity of the ocean geographical and by centrifugal force of the Earth's rotation acted on by the Moon and Sun is the cause of the diurnal tidal inequality, s 320 and context. Cor.(a) The old world dam to movements of the Indian Ocean, and the eccentric position of the latter, gives rise to the diurnal tides and Monsoons of these regions. Cor· (b.) The Atlantic being symetrical or nearly so on its meridian with respect to north and south, can possess no diurnal tide of its own development.

MIST. Mist was universal, hiding the Sun's disc in the Ice age immediately before the flood of Noah. s 142 and Cor.

MOON. The times of New and Full Moon are the times of the greatest Precessional, Nutational and Secular Retardational movements, and the times of the greatest storms, earthquakes, and electric manifestations, by reason of the gravitational movements of the fluids of the globe and their eccentric being greatest at these epochs, s 1—330 and Cor,

MOON and weather. s14, 92 & context.

MOSAIC COSMOGONY, that of Genesis, and including the Creation and the Flood, stands unshaken, and the doctrines of Darwin and Evolution are untrue. s 142 and Cors.

MOTION. Motion of matter in relation to the mechanics of the universe and the inaminate forces of nature, can only be produced from motion of matter, and motion of matter and force are identical, and there can be neither without the other, and all manifestations of force, are manifestations of motion of matter, or to define the proposition as a theory, we may say EVERY FORCE IS A MODE OF MOTION OF MATTER. s 227, 274, context and Cors.

MONSOONS, in and about the Indian Ocean, are winds caused by the same forces which acting on the waters of the ocean produce the diurnal tides, which forces act in excess in the solar day hemisphere of the globe, so that the monsoons represent accumulated diurnal effects, oppositely directed in alternate half years, and synchronating in period with the variations of diurnal tidal phase with respect to night and day in alternate half years. From the Vernal Equinox to the Autumnal the force acts on the fluids of the Indian Ocean, the air and water, from South to North, and is greatest at the Summer Solstice, from the Autumnal Equinox to the Vernal, the force acts from North to South, in respect to the equatorial protuberance of the fluids near India and the eccentric position of the waters of the oceanic basin to the south of India. Thermal action plays no direct part to produce the

Sun's high temperatnre is in the pho· tosphere and external strata of the Sun, while beneath the photosphere the Sun possesses a cool[1] surface and conditions compatible with being the the abode of life, especially of marine life, s 173. Sun's light and heat mechanically produced by kinetic movements of magnetic ponderable masses reciprocating in 1.1 second of time, or by a magnetic ponderable nucleus rotating in this period, s 142 p. 43. Circulation of the solar atmosphere is gravitational and resembles that of the terrestrial atmosphere, s 106. Sun is subject to Nutation, s 184. Sun's light and that supplies the energy of the Earth's rotation, and so indirectly gives rrise to the Atmospheric Circulation and other phenomena dependent upon the rotation, s 288, Prop. 40 & con.

TABLE of baromeric distribution of air pressure, p. 28.

TAHITI is the node or fulcrum of the kinetics of the Oceanic Tides, s 304 and con. There is no real tide at Tahiti, but the 24-hour change of level of the ocean waters at Tahiti with high water at 0 o'clock noon is due to a diurnal displacement of the Earth's centre of gravity of which that change of level is the index and marking a diurnal rotation of the centre of gravity round the centre of form. s 142, 283, Prop. 35, and con. The tides should be referred to Tahiti time, s 313 and con.

TANGENTIAL or horizontal oscillation of the Pacific or Polynesian Ocean is accompanied by vertical movements of the waters. s 264 and con. The tangential motion of the Earth in the orbit about the primary, the Moon or Sun, disappears in a quarter revolution, while an equal quantity of mo· tion is created in a rectangular direction, and both these effects are by gravitation of the primary orb. s 136, context and Cors.

THEORIES. All theories of the Tides which do not recognise the eccentricity of the fluids of the globe, are worthless, s 299, Cor. This applies to both the longitudinal and meridional eccenricity in respect to the semi-diurnal & diurnal tides respectively.

THEORY. Radiant Theory of the Tides s 300 and con.

THERMAL gradient, is inadequate to produce the Atmospheric Circulation. Any thermal circulation at the base of our atmosphere can only be directed from that part of the Earth most distant from the Sun to that part of the Earth where the Sun is overhead, and this is the only effective thermal force acting to produce thermal convection and wind arising therefrom. The difference of temperature at the opposite ends of that diameter of the Earth which coincides in direction with the radius vector of the Sun, the day and night ends respectively, this is the thermal-gradient-effective for Atmospheric Circulation. The effect of this gradient upon Atmospheric movements has never been recognised, it can easily be calculated, and the calculation shows that it can have no appreciable effect on air movements. But if we regard the difference of temperature on Equator and the Poles as the effective thermal gradient this is about 1° Faht. in 100 miles, and on a uniform density of air 15 lbs to the square inch the Atmospheric limits would be elevated by this gradient less than about 1 foot in 1 mile, an elevation not sufficient to overcome viscosity either of the air or ocean waters, and so insufficient to produce any Atmospheric Circulation whatever. Barometric gradients outweigh thermal gradients many hundred times, and it is clear that the former cannot be due to the latter, as well might we expect water to flow uphill, and rivers run from valleys to the top of mountains, as expect thermal convection to produce the Atmospheric Circulation, with its dependant oceanic currents. s 4 —10, con. and cors. Thermal theory of Atmospheric Circulation must be entirely abandoned. s 53, con.& cors.

THRACIAN north winds and the New Moon, s 92—93.

TIDAL protuberances are quadrantal, in longitude not hemispherical, s 247 and eon. Tidal Circle, is a circle of high atmospheric pressure coinciding with the lunar orbit or

ecliptic circle, and these circles are most important factors in weather phenomena, s 24—35, and context. Tidal compress aids orbital force to produce the Atmospheric Circulation and Oceanic Tides, s 34 and con Tidal force is a tangential force. s 249. Tidal Circle possesses acumulated air s 29, moving from east to west s 30, accumulating, distributing and dispersing by Earth's rotation. s 31—32.

TIDES would cease to exist if the ocean and air were spherically—symetrically disposed round the globe, s 267, con. & cors. Tides are largely due to winds s 238—240 and con. Tidal crest of action and trough of reaction s 251. Tides by the Sun are central to those by the Moon in Polynesian waters at the time of spring tides and neap tides, in the former case in like phase, in the latter differing by half a wave period, s 312.

TRADE Winds. Their power to affect the level of the ocean, s 238—243, Cor. The Monsoons affect the level of the ocean, and if there is a diurnal variation of Monsoon force, this would affect the diurnal tides. How the trade winds are caused, s 33 and con., are lost in the great low-tension system of air movement the primary circulation of the Atmosphere, s 328, Fig. 24, and con

TREATISE, the principles of this treatise, once recognised, will lead to a proper weather science, s 123.

TROPICS of Cancer and Capricorn receive air and barometrical pressure from the Ecliptic plane or Tidal Circle by the action of Tidal Compress, Orbital Force, and the Earth's Rotation, s 33 and con.

TWINKLING of stars is due to magnetisation of their light, s 142.

TYPHOONS are developed by swirls or currents of air of more or less permanent type and character. s 104 and con.

UNDULATORY or Radiant Theory of the Tides, s 300 and con.

UNIVERSE, is a kinetic arrangement in respect to matter and energy. s 227, con. and cors. Cor. The space occupied by our universe is the dwelling place of matter, motion,

consciousness, mind, and these are correlated as conjoined entities. There may be many other universes not formed of matter, motion, consciousness, mind, but of other entities, and of which we can have no cognizance, but consciousness and mind may be regarded as links between the material and nearer spiritual universes.

VARIOUS forces are concerned in producing the Oceanic Tides and the Atmospheric Circulation, but eccentric and protuberant portions of the fluids are the indirect cause of the former, s 323 and con., and also contribute largely to the latter, s 314 and con.

WINDS of high tension and velocity are due to barometrical pressure arising from great air movements of low tension and velocity, but affecting vast masses of air or the entire atmosphere, s 328 and con. are due chiefly to gravitational action of the Sun, Moon, and Earth upon the air. s 56 and con., but in high latitudes are largely due to electro-magnetic deflection of air. s 325 and con., are developed largely as a consequence of the eccentric distribution of the air basins and as tidal winds, s 283, con. and cors., are the expression of the forces producing the movements of the air and other fluids those which effect Precession, Nutation, and the Earth's rotation, and limit the velocity of the latter s 283 and con. The winds of the primary circulation are the reverse in directions to those required by a thermal convection view, s 53. con. and cors. and are shown by the loops. A, B, C. D, of Fig. 24, p. 132 Winds in general s 1—330, con. and cors.

X $\bar{x}$ great developments may be expected in natural science, more especially in meteorology, astronomy, and physics, when students and scientists give proper attention to this treatise, and digest and assimilate the contents.

YEARLY variation of Tidal throw, s 320 and con. ,

ZODIAC. The "light of the zodiac' is solar light reflected from a ring of hydrogen particles existing in space

around our globe. This ring is a belt or girdle in the equatorial regions, the outer member of the Ice Age series, i.e. of those which have made contact with our atmosphere. Contact of the ring with our atmosphere is daily developing, and soon the ring will be engulphed and descend bodily upon the globe, and everything on the Earth's surface will then be consumed in fire. After this the Earth's surface will doubtless be created anew, for CREATION IS THE LAW OF THE UNIVERSE, and under God's power worlds are born speedily without waiting endless ages of evolution. There have been several Creation epochs in the life history of this globe, and doubtless there will be several more. All life appears to have been destroyed off this globe by ice at the period of the Ice Age, and subsequently restored by the Adamic Creation, a rapid process as described by Moses in Genesis, and that in new forms to those of former periods. For what appears to be the second time the ring system is again to destroy the globe, s 142 and con.

AUTOBIOGRAPHY.

The Author of this Treatise was born Feb. 5th, 1851, on the abutments of the first iron bridge that the world ever saw, that over the Severn, built in 1779 by the Coalbrookdale Iron Company. Only the gable of the house of my birth is now standing, railway construction having removed the other portion of the cottage. Soon after my birth my parents removed to the old Baptist Chapel house, and finally settled down at the Orchard House, Broseley, the latter a large imposing house for a small town, and with a magnificent orchard and garden, and around these houses are associated my earliest memories. My first memory is that of taking a kitten to the school of Mrs Jones who taught young children near by the chapel house where we then lived, and I remember being pinned to Mrs Jones's apron to keep me from running about the school. At Orchard House my mother —whose father was a farmer—kept cows, poultry, &c., while my father walked every morning to the Coalbrookdale Ironworks, a distance of two-and-a-half miles, reaching there at 6 a.m., and leaving again for home at 6 p.m. He was a foreman dresser in the works referred to, over a few dozen men, a position he attained when eighteen years of age, and retained to the day of his death at sixty-five. He was paid piece work, i.e., for what the whole shop could produce, engaging his own men on his terms, and after paying his men retaining the balance as profit to himself. In his own department he was the hardest worker and best workman that I ever met, very ingenious and could invent tools and other things required to aid him in his work, opinions I formed when working with him for a few months when I was about fourteen years of age. My oldest memory of the Orchard House is that of being attacked when a boy in petticoats, by a boar pig of great size and ferocity. Having seen the ringing of other pigs, I thought I could ring this monster, and unmindful of the great tusks which curved upward from his jaw, as he grazed in the orchard, I endeavoured to lasso the formidable jaw with a strap. At the third attempt to my surprise and consternation, with a horrible roar and a most ferocious appearance which —there could be no mistaking—indicated death for my-

self, he turned round and leaped upon me, bringing me instantly to the ground, and commenced to tear me to pieces with his tusks. But Providence had a better destiny for me, I was not to be killed and eaten by a boar, for at a few paces distant, on an apple tree which I could yet identify (and even the very bough from which the swing hung if it is yet standing) my brother William, a very small boy not three years older than myself, and very diminutive for his age, was seated on a swing, swaying to and fro. Hearing the roar of the beast and seeing the attack, he leaped instantly from the swing, looked round for help, there was the wooden prop holding up the clothes line, an old fashioned natural branch of a tree with a V shaped end, and seizing this he ran at the boar, brought it down on to the latter, peppering him with all his might, and so drove the animal away, and I was saved. Plucky fellow, when I speak to him about it, all the credit he takes to himself is, "Thank Providence for placing the line prop there, for without it I could have done nothing." I escaped with torn clothes and one solitary scratch. Mother was very angry when father brought the boar to the farm, and now she peremptory demanded that it should be removed instantly, and no more risks taken, which was done. My next memory is that of going to Broseley National School taught by Mr Ledger, for whom I always entertained the greatest respect. I was very young at this time, but I remember being usually clad in a clean pinafore of white linen, as were my brothers also, and upon one occasion weeping when the frost nipped my fingers on the way home. But in one of those winters, when the old deep pool was frozen, and nearly all the school assembled round the ice after a thaw which had left it in a dangerous condition, amid the cheers of the spectators, I dared more than any boy present, and went further on the ice than any other boy, but alas went too far and fell through into deep water at a considerable distance from the shore. Ever fertile of resource, and of quick action in emergency, I made for the shore by the shortest direction, along that of the deepest water, and seizing the ice, and throwing my weight upon it, and breaking it into lumps, I used the inertia of these lumps at once to keep myself afloat, and propel me ashore, as I pushed the lumps of ice under me and backwards. In this way I reached the shore safely, and after being helped out of the water, was led away to the house of my aunt Helen, an aunt on father's side, who dried me in front of a large fire with-

out taking my clothes off, and a sorry and funny spectacle I presented while being dried. When nearly dry a policeman turned up and I was sent home in his charge. Oh, then, when my mother saw me, ": Poor child. Get hot water, get the bath tub," these were her orders given quick, with many reproaches that my aunt had not acted in this way, and soon a warm comfortable bath and wash, and a rig out in other clothes. and I was as right as the door nail, glorying in my adventure, but resolving never again to venture on soft bending ice. This escape from drowning was escape of my life No. 2. The following winter I was again through the ice in another pond, but this time not in deep water. When a little older, a vicious horse loose in the traces, ran forward and lifted me by the neck and shook me like a rat, and then threw me several yards from him, dead so the horse thought, but this time the thick collar of my winter cape saved me by receiving the bite intended for my neck. Six months after this the same horse attacked and killed a man in the field where it was grazing. The last I regard as escape of my life, No. 3. Once, and when I was about twenty years of age my head was nearly in the jaws of a large mastiff dog, hut instantaneous action on my part saved me on this occasion. About the same period I received a double legged kick from a horse in my stomach and was within an inch of losing my life. Amid all these events, my life flowed happy as a marriage bell. I loved all nature and this contributed greatly to my happiness, and I had the kindest and most considerate of parents, brothers, sisters, and friends. Speaking of my love of nature : my first entry into the dingle, a quiet glade near Broseley, with its red sandstone cliffs, its wood, flowers, and stream, was like a discovery and brought great joy to my young heart, but passing through this same Dingle in the gloaming, produced many and weird thoughts in my breast. Not that I knew fear, but my wonder and curiosity was aroused. But the happiest moment of my life was when standing on the aforesaid iron bridge, I heard the shriek of a distant whistle, and looking up the river, saw approaching at full speed the steam tug, the first steam boat I had ever seen. At this time the Severn Valley Railway was building or nearly completed. And now when it was completed, as a boy of twelve years of age or so, going from Broseley to Coalbrookdale with my father's dinner, I heard the train approaching from the direction of Buildwas. Oh how my heart leaped, for months and

years I had been ardently desiring to see a locomotive and a train, and here it was coming, and as it swept round the curve into the Ironbridge Station, the large new beautiful brass-domed locomotive, I could have embraced it in my arms, had I been permitted to do so. I was supremely happy. The dream of weeks and years was realised. I had seen the locomotive. One of my oldest memories is that of seeing the aurora borealis, or the northern lights of which I had never heard until I first saw them. They dawned upon me like a discovery. Later a joy of my life was the great comet of 1858, through the tail of which I remember seeing a star very distinctly. Perhaps it was this comet that directed my attention to astronomy more than any thing else. My Sabbath school teacher at the Broseley Congregational Chapel was Mr Glaze, a porcelain worker at Coalport. I was very fond of Mr Glaze, and at a very early age was in what would be a senior class, taught by him in the vestry. Here I puzzled him with questions about the Sun and light, which he could not answer, and which in later life—after I had not seen him for years—he assured me were always present to his mind whenever he thought of me, and which " always made him laugh." He was not astonished when I replied that since we last parted when I was a boy, I had written a book on the Sun, I refer to my treatise " The Sun a Magnet." Thirsting for knowledge, as a youth in the ironworks, in the workshop of my father, I questioned my uncle George, my father's brother who worked for father, a nice patient docile man, but the only response I could get was " Dunno bother me John, go and count the stars." The engineer of the works had constantly to drive me from his engines. Week in and week out I was never tired of looking at and studying the latter, but he was inexorable and only by stealth could I get an opportunity to do so. When I met him years afterwards he remembered these incidents. When living at Broseley, the distant furnaces "Blessed—hill furnaces" reminded me of anything but Blessed-hill. I thought of hell, where the fires never go out, for every night those fires lit up the sky with a lurid light, and I was assured that they were also always burning by night and day. But the mystery of these furnaces appeared to be too deep for my investigation, although in connection with them my curiosity was greatly aroused.

When I was a very little boy, too young to associate with my big brothers, they played truant from school, and went from Broseley to Much Wenlock Olympic games.

But "little John" also nicknamed "fatty" (with his round face) was not to be done, and all alone I tramped from Broseley to Wenlock, a distance of four miles, the longest distance I had ever been from home. How they stared and all their companions when amid the glory of the games, "little John" presented himself on the course, and I venture to say that no person in that field on that afternoon enjoyed him or herself better than I did. But a bad time was in store for me, for on the way home at night E—S— (now in his grave) played a trick on me which nearly finished my course. Asking me to keep in his pipe as he had no more matches, he plied it again and again until "little John" collapsed, and was as near kingdom come as ever he was in his life, not excepting the interview with the boar. But again "little John" pulled through, for after lying down to die by the side of the road, he recovered sufficiently to be carried, brother Tom at one shoulder, brother William at the other, E. S. at the one leg, J.H. at the other, thus away the group set out in the dark over the few miles of fields and roads intervening between our position and home, but before attaining the latter I was able to walk unassisted, and on reaching home, to slip up to bed unperceived. I learned a grand lesson that night. Ever logical, I reasoned that the thing which could take me so near death's door could not be good, and from that day to this, I have never smoked tobacco. E. S., poor lad, in comparatively early life, leaping from a vehicle, received injuries from which he never fully recovered, and for many years he has been in his grave. He was a nice fellow, very good looking, of splendid physique, and his mother a nice woman whom I knew well, must have loved the Sun, for, when I was quite a boy I remember hearing that she had been blind for three days with looking at that orb. Often when I have been tempted to gaze at the Sun with my naked eyes, remembering this story of Mrs S., I have acted cautiously. Necessarily I have had to take some risks to my sight in dealing with the question of what is the Sun? At a very early age, when a mere youth, it was a presentiment in my mind that that question involved my life's work, and that I was born to successfully deal with it, and to tell the world what the Sun is. Love of nature was the strongest passion of my youth next to love of God, but God always seemed to me to be omnipresent in nature. My love of nature was as it were my love of nature's God. I loved nature best in her wildest moods, and when the whirlwind was shaking the apple trees and pear trees of the old orchard at Orchard House, of

which there was a superb variety sufficient to satisfy an epicure or fruit connoisseur of the most refined tastes, amid the roaring of the thunder, the showers, and the flashes of lightning, "little John" would dash out of the hayloft or barn in among the trees and snatch up the golden fruit as it lay on the ground for the picking up, and bear it into the shelter, and share it with my companions. Those were happy times varied by fisticuffs with wisps of hay tied round our hands for gloves, when we would box in the hayloft hour after honr, practising as we said the noble art of self-defence, which was an art very much needed among the young at Broseley. As a boy I have been in many a fight and usually came off victorious, but never struck the first blow. My darling mother whose soul is now with Jesus, would never allow her children to strike the first blow, and was averse to quarreling, but a woman of undaunted courage and spirits herself, one who could never endure to be sat upon, it was sufficient apology for our fights if we could say that our opponent had struck us first. Honestly speaking, I rather liked the excitement of a pugilistic encounter in which 1 was one of the principals, but never had any taste for seeing others fight. A phrenologist has assured me that I have the bump of combativeness in an extraordinary degree, and would resist an injustice almost to the death, at the same time he said, that to look at me, any ordinary person would suppose me to be, the mildest of the mild. I have no hesitation in saying that this phrenologist was right, as the same gentleman (almost an entire stranger to me) was upon every point. But of this later on. Let me say here, that my brother William, the hero of the boar incident, the smallest in stature of my six brothers, was the pluckiest and most indomitable youth I ever knew. He never was beaten, and on one occasion fought a pitched battle in a ring in a field before the whole school of Mr Truelove, by whom he was educated, fought successively two brothers Richard and Henry Instone, both of whom were taller and heavier than William, excellent built, well-fed youths of strength and energy, and one of which, if not both were older in years than William. In later years William achieved considerable distinction in amateur athletics, and is now a town councillor in Longton, Staffordshire. In consequence of the boar incident I have always almost worshipped William, and he has only to command me of anything reasonable that lies in my power in order to obtain it. As a family of seven brothers and seven

sisters, a perfect and complete number of each, of the ten who survived to years of maturity, we were all affectionate towards each other and never had a quarrel or grudge one against the other, but pugnacious, though noble minded William, was tacitly acknowledged by us all, cock of the group. Father was a man of deep affections, and great piety and love of God at heart, with an ever present "God bless you" for his children, which were also words of my mother, words ever on the lips of both father and mother, and mother loved her children, almost to distraction, especially when peril threatened any, or any one had been in peril and it came to her knowledge, and I have seen her in her concern for the spiritual destiny and well being of one of her children, pull the hair out of her head. On behalf of her boys she preferred death to dishonour or departure from holiness. To my mother's superior endowments, deep insights and perceptions, and the faculties associated with her high strung nervous nature and quick blue-grey eyes,(which by the way were similar in colour to father's and my own), and her love of discussion and investigation, and her splendid conversational powers, and her great faith in Providence as an ever present God presiding over our destinies, and to her belief in her children in general, and in " little John" in particular, and to her splendid imagination and perception, gifted largely to myself by heritage, to her I owe largely what by the grace of God I am. To my father I owe physical strength and energy greater than my light weight (9 stone 10 lbs) would suggest, but also constructive and inventive powers. Assigning imagination, perception, and judgment to my mother, and imagination and constructive invention to my father, to these gifts more than to any other, inherited from them, I owe any powers I possess of dealing with natural science, and its difficult problems. The marriage of my parents was a very romantic one. There cannot be a doubt but this marriage was made in heaven, at the same time also, that my father was the genius of the movement, and effected the marriage in a manner such as to show that as a young man, he was endowed with very considerable diplomacy and resource, and I think that his choice showed a good judgment also, and the manner in which he effected their runaway marriage, a very just estimate at once of the vanity of women and of cause and effect. I have reason to believe that at the time of my parents marriage, my mother who belonged to a physique that ripened very late in life, though twenty years of age, was scarcely a mature woman, and

possessed little or no desire to marry in general, nor any desire to marry my father in particular, though she did not altogether repel his advances, and at least felt flattered by his attentions. Mother was trifling, father meant business. He had first met her at her brothers, at the Crown and Anchor Hotel, of which the latter was proprietor at Broseley, and at once recognised that besides being likely to be an heiress to her grandma, Sarah Palin, of Kinnersley (who possessed considerable wealth in her own right and which only referred to a portion of an estate in which she was thrown to the thirds), she was a most prepossessing young lady. Tall, slender, genteel, polished, kindness itself in heart, with hair almost lint white, of excellent constitution and parts even to her teeth now so rarely perfect in many people, father having set his heart upon her, could not be denied such a treasure if it could be possessed at all on his part. But she was obdurate, she refused to marry, she pleaded that she was too young to marry, and besides that she had no intention to wed my father. How then were her fine perceptions and imagination to be united with his strength of manhood and mechanical and constructive skill, and bye the bye, father played the flute in the congregational choir of Broseley, and taught a Sabbath school class there. He also sang in the choir, with a somewhat nice voice which he used to speak of as falsetto. I mention the flute, as he was passionately fond of music, his favourite hymn being the one on death, "Lend, lend your wings, I mount I fly," and I remember that his favourite psalm was the 104th psalm that treating most largely of nature. He was passionately fond of nature, the fields, the woods, the rivers, the seas, and landscapes generally, and delighted to contemplate these. I am aware that these are qualities which many persons possess, perhaps most persons, but father possessed them in an unusual degree. In his personal tastes, he liked to shine in his own circle of friends, he even liked to be flattered, but any kindness shown to him would melt him almost to tears. Gratitude and love were special features of father, and he was of what I might call, the emotional temperament. Mother's delights were rather in the spiritual world, and in seeking the welfare and salvation of her fellow creatures. Her heart was with Jesus and in heaven, though her choice of a house from time to time as a place of residence on earth, showed that natural beauty of situation and environment weighed with her to some extent. In her prayers, in which she always took great

delight, her mind used to reach down the ages and in a way so as to comprehend every person related to her in near kinship or blood both alive and yet to be born, more especially to her own children and grandchildren right down to the latest generations. Her spiritual vision seemed to grasp the present generations and all to come, and she had a marvellous power of prayer embracing all, with a faith in Jesus whom she always called " Dear Lord" which never for a moment wavered, though she used frequently to assert that as a young woman she had been very vain, proud,and haughty, until her heart was changed in conversion. But for these assertions due al- lowance must be made; I never heard any other person say such things of her,but as a young woman that she had a touch of pride and vanity is probable, and what young lady from sweet seventeen to marriage has not. The qualities of her youth which she condemned, were doubt- less, strong personality, individuality, and imperious- ness arising from the conscious possession of gifts often denied to others, and considerable pride arising from this consciousness. Her qualities were those which in the animal world I would assign to the lion and lioness, which are perhaps the most proud members of the animal kingdom, and shall we say, justly so. But after conversion, she appeared to lose herself entirely in God's will, her natural gifts becoming sanctified to spiritual uses, the one object in her life, being the salvation of her husband, family, and neighbours. Of her own salvation she was absolutely sure, and this appeared to cost her scarcely a thought, but her anxiety for her husband, children, and friends, has sometimes greatly agitated her, even to tears. Brought up an Episcopalian, the strictest of the strict, living at the very church door at Sherifhales; after her marriage she was induced to, or did of her own free will, attend the Congregational Church, Broseley. But she had not been a member there for long,and following her conversion, before she was led to believe that she ought to be baptized by immersion and join the Baptists. (By the way, my great grandfather William Jones, also of Orchard House, Broseley, appears to have been a Baptist, for his grave, marked by a stone and an inscription is to be seen in the Birch Meadow Baptist Chapel,Broseley,and also my grandfather Richard Jones—whom I remember well, was a strong built man like his sons, and was cooper to Lord Forester and other gentry—also my grandmother Mrs Richard Jones —whom I remember well as a tall well built woman).

Mother announced to her Congregational minister, who loth to lose my parents as members, gave her a book to read written by a Wesleyan minister, to prove that infant baptism was right. This she read, and on the Congregational minister asking what she thought of baptism after reading the book, she replied, " I thought it my duty to God to be baptized before, but now I am quite convinced that it is so, and that believers' baptism and that by immersion only, is the only true and scriptural baptism," and the upshot was, that acting on this belief, my mother, father, a Mr Boden, Mr Legg, and another person, were all five baptized together, by the Rev. Mr Yale, at the old Baptist Chapel, Broseley, when Mr Yale composed a poem or a hymn for the occasion. It was a red letter day in the lives of all five, and all had a great gift of prayer bestowed upon them, as if the Holy Ghost had descended in power upon them, but more especially upon Mr William Boden and my mother. In prayer Mr Boden appeared to bring the heavens down, but sometimes after partaking of wine at the communion, or of beer at the house of some uninstructed, and on this point ignorant Christian friend, an old taste was roused, which brought him nearly down to hell and the grave, but despite all this, I never had a doubt but that he was a true child of God, and doubt not but that he is now in the kingdom of heaven waving palms of victory over sin, and never to fall any more. Alas that the church should diet its children with alcohol. " If a man ask bread will ye give him a serpent." It is a greater crime on the part of ministers of the gospel and professing Christians to put the intoxicating cup upon the Lord's table and upon their own tables than to keep a common drink shop and sell intoxicating drinks. But to return to my father's marriage. He wanted Miss Maria Palin, my future mother, to choose a silk for a wedding dress, and brought her patterns from a neighbouring mercer, in suitable colours, but she declined to choose, saying she was much too young to marry and had no thoughts of marriage as yet. On this he said, " Tell me which you like best," to which she replied, " Well if I was choosing,that is the one I would like," indicating one of the colours. Upon this he purchased sufficient of the silk to make a dress, and handed it to a local dressmaker with instructions to make it in suitable style for his intended. How the dressmaker obtained the size I was never informed, but the dress was made and delivered to the prospective bride. My father then invited Miss Palin

to accompany him from Broseley to Wolverhampton races. They drove in a vehicle to Wellington, the nearest railway station on the route, calling at a draper's shop in Ironbridge on the way, where father purchased everything that was needed to complete the bridal outfit. Up till this time little did Miss Palin suspect that she was being dressed for her marriage. But arrived at Wolverhampton (and they say fortune favours the bold) father proposed that before going to the races they should get married. He obtained her consent and they were married by special license, returning home to their own house that evening, which latter father previously had the forethought to provide. There was not a great deal of furniture in the house, but there was sufficient for two, and father was in a position to speedily add whatever else was needed. In due time the first John of the family was born, a beautiful boy, a born naturalist, seeking living specimens and crowing over them in the garden before he was two years of age, but declared by the grandmother on our father's side to be too beautiful and good for this world—though his young mother little heeded the warning. When about two years of age in full health and twenty-four hours before the child died, the grandfather on mother's side had a presentiment of coming death to the child, and warned both my parents. The blow fell, seized with croup, which frequently threatened the first members of our family, the child died after a few short hours of illness. Then my father rolled distracted and weeping on the floor, but mother held up bravely to comfort him, " Tuts man, we shall have some more," she said. " No, no," said father, refusing to be comforted, " we shall not have any more." They lived to have five more boys, and seven girls, and to name another boy John, the fifth of the family, viz. your humble servant the writer. The first five of the family were boys, all with white or flaxen hair except your humble servant, who though not dark, but possessing mid-brown hair, was the darkest of the family, including all the girls. We were all so like one another in individuality or expression, that those who knew one of the family knew all wherever they met them. Father and brother Arthur travelling to Scotland, coming to Dundee to see me, were at once recognised at Perth by a neighbour of mine as being my father and brother, immediately they at Perth entered the Dundee train, though it was an entirely unexpected interview, and this neighbour who lived next door to myself brought them straight to

the house. An expression or roll of the eye, dependent on the cable anchorage in the orbit, and a certain shape of the temples, appears to have been common to every member of the family, otherwise there were considerable differences of feature, while doubtless also there was something common in the voice. All my brothers and sisters were clever at school, (Richard perhaps the most clever) unless my brother Thomas be excepted, and he had only average abilities but possessed the finest physique of the family, and was always a great favourite with his father, who was very proud of such a strapping boy. But Richard was the cleverest after the first John, and struck every one he met as a born gentleman. As he grew his hair did not darken much, and as a man he had beautiful flaxen hair. My sister Emma was and still is a marvellous player on the piano. Born in the same valley as the renowned Watkiss, her teachers declared that they had never met such a player, certainly her playing pleased me better than any other player I have ever heard ; she has taught the piano, and taken first prize on the piano at an open competition musical bee at Broseley. But enough of family details, and to return to myself. I have a memory of almost every kindness done to myself when young. Especially do I remember the kindness of some lady friends of my mother and their lessons and counsels to me. I think I was a great favourite with my mother's sister, my aunt Davies, now no more. I remember my mother's sister, my aunt Pitt, a very beautiful woman, who died of decline, probably the dregs of typhus fever contracted when young. On one occasion when I was a very little boy I had been taking her water cresses, of which she was very fond, and to which she assigned medical virtues, and she had given me a shilling. I felt that this was too much, had she given me a penny I would have kept it, but she would have no refusal but forced me to take it. Passing her cottage window I perceived that one of the panes of glass was broken, and I dropped the shilling through the hole of the broken pane back into the house, and sought to escape round the corner. But she heard the coin fall, and instantly rushed to the door greatly agitated, and to allay her feelings, much against my will, I had to accept the gift. I remember her beautiful face, made more beautiful by the nature of her illness, but the above is the last incident of her life that I remember. I have a dim memory of my aunt Wood and her daughters, but no memory of any other of my mother's brothers

and sisters. Typhus impaired the constitutions of most of my mother's brothers and sisters when young,and led to comparatively early death, but mother was one of the family that escaped untouched by that disease, and so lived to a good age. Though my mother was of a genteel light slender form, rather tall as women go, and of mental nervous temperament like myself, in many of her characteristics resembling a blood race-horse, she was very wiry and healthy, and retained the full possession of all her mental faculties up to the day of her death at 76, a good report of the health of one who had borne fourteen children, and at death she had a terrible struggle with pain before finally passing away in peace. She was strong in death, and of her life " I do like that woman" were the words of those who knew my mother best and who came in contact with her large hearted and spiritual mind, and found that she was ever ready to counsel and advise, a bright and shining example, and ever concerned for the spiritual salvation of every one whom she met. Her realisation of good desires and a divine life appeared to be more perfect than what is common to the lot of most Christians. She may have made mistakes and committed errors of judgment, but I never knew her to sin wilfully, or to do a selfish act which wronged or injured another, but it must also be owned, that she had little patience for wrong doing in any form by others, and could not understand why every person should not be virtuous. And so on this account perhaps she was often misunderstood by her neighbours or i.e. made few friends beyond her immediate circle, but she certainly never made a single enemy.

At 14 years of age " little John" followed his brother drapers Richard and William, and went from his home, (now at Coalbrookdale),to Liverpool, and became apprentice to Wm. Morgan & Co.. a very large firm of drapers, in Scotland Road of that city. Here I was not happy. The apprentices boarded in, as did all the counter hands, with few domestic comforts, and this contrasted cruelly with the happy home I had left, and the city itself was a brick wilderness when compared with the sylvan beauties of Coalbrookdale, and the green fields, woods, meadows, and other scenery of the Severn valley in the beautiful borderland of Shropshire. It was like going from heaven to hell, and often did I wish to break the bonds which confined me to the city. But under a sense of duty I held on, and only once asked to be released. There were eighteen apprentices in all, and of these fourteen took to drinking; in several cases associated with

other wild ways, and several died premature deaths soon after finishing their apprenticeship. But your humble servant the writer kept his garments comparatively untarnished. I escaped "by the skin of my teeth," but never would I knowingly put a son of mine or any other person under similar peril. Perhaps my escape was largely due to my love of reading. In my youth I read everything that came in my way. No reading seemed to come amiss, and thus I was storing up a considerable general knowledge, and acquiring the power to observe and to think. There was a free library near hand to Morgan's, and I availed myself of the same, my favourite literature being the English Mechanic, a periodical largely devoted to science. There were discussions and articles in that paper which helped to develope in me the faculty of logic and of thinking. Be that as it may between the years of 14 and 21 I conceived an ardent love for natural science which has never left me, and in subsequent years I have attended classes at the Y. M. C.A. rooms, Dundee, and at University College, Dundee, and done some experimental and laboratory work at the latter. At 23 years of age I was offering my theory of the Sun, its central magnetism and mechanics, to the Royal Society, Edinburgh, through the medium of Professor Tait, but at that time it was comparatively crude. This of course was previous to the observations made at Dundee on Oct. 19th, 1879, when the period of the central movement in the Sun was revealed to me. Later the $3\frac{1}{4}$ in. achromatic refractor I obtained from Lancaster of Birmingham to view the Sun, made known to me the coralline and calcium character of the lunar structure and face, this discovery being briefly described in my little book, " New Selenography." This was an instantaneous, sudden, and altogether unexpected discovery, because I had quite thought that we knew all about so near a neighbour as the Moon, and having only a special and great interest in origins, for long I forbore even to turn my telescope on that orb.

In recent years I had occasion to give an essay before the Literary Society of Ogilvie Free Church, to show how the Sun's heat produced the Atmospheric Circulation by thermal convection, only to discover when preparing the essay that the facts did not agree with the thermal convection theory, but that the winds and currents of air were in general going the wrong way over the surface of the Earth consistently with thermal views, and eventually I was led to discard thermal convection

entirely in this connection, and to make the discoveries and embrace the views of the Atmospheric Circulation given in this treatise. Then with regard to my discoveries and views anent Gravitation, the Oceanic Tides, Precession, Nutation, Secular Retardation, the Earth's Rotation, and other results as given in the treatise, their development is largely manifested therein, and on these I need not here dwell, but commit the whole to the judgment of my readers and to posterity. Married at Dundee to Isabella Buchan Baird, a Dundee lady, on July 18th, 1876, the union has been a fruitful one. Blessed with seven boys and three girls, we have only lost one, a little girl taken away the day after Christmas eve, 1882, at a time of the absence of myself from home. Every incident of that period is fresh in my memory, even to the chirp of the robin that in my loneliness and darkness came under my window. Sweet bird! it brought hope to my breast in a dark hour. Valuing reason more than life, I could neither submit to have it taken away, nor could I submit to the declaration that I had at any time lost it, and in the Providence of God, I think I have been fully vindicated, my words, on the occasion of the incident referred to, being, "we shall be vindicated," but for a moment I distrusted Providence, or invoked Providence, I don't know which, and became desperate, with nearly disastrous results, but results eventually successful, and "all is well that ends well," and I have been spared to do the work of this treatise and complete its pages. Recently my eldest son George William has taken his M.A. degree with honours at Edinburgh University, and is a medallist there several times over, the other members of the family are all very much what I could wish them to be, and I hope it will not provoke any person to jealousy, but most of them have been said to be clever at school. John, the second eldest, assists me in my business, David, a very promising boy, is at the High School, Dundee, but is coming of an age to look out for employment. I need not say anything special of the others, but the least intellectual of the group is a good average, while in physique, like myself, they all enjoy the best of health. The doctor has been almost a stranger at our house, except on those special occasions when there was to be an addition to our number. But we must not boast, for "we know not what a day or an hour may bring forth."

To the admirers of the poet Burns, I may say that a kind fate or otherwise, has sent me two original oil portraits of the poet, the one by Henry Raeburn, and the

other by Alexander Reid, and I take this opportunity of asking an interest in these portraits as well as in the work of this treatise. The former of the two portraits ought to be in the National Gallery at London or Edinburgh, but I cannot afford to present them, but for a consideration might be induced to part with them, which consideration shall be moderate if assured that the former of the two portraits shall be gifted or sold to either of those institutions. Those persons who shall possess a copy of this treatise, if they desire, may have the privilege of viewing the portraits here referred to. Should any publisher be desirous of publishing a life of Burns, or life and poems, the portraits would be useful for embellishing and promoting the sale of the work.

The poet Burns is said to be the only poet who ever signed himself "Poet," and posterity has confirmed his judgment upon that point. In signing myself "Natural Philosopher," see p. 43, will posterity confirm my judgment. I have not written sweet songs like the poet, but I have loved nature as ardently as he loved poetry and the lasses, and "Nature never did deceive the heart of him who truly loved her."

Sunbrae, Bingham Terrace,

Dundee, June 9th, 1903.
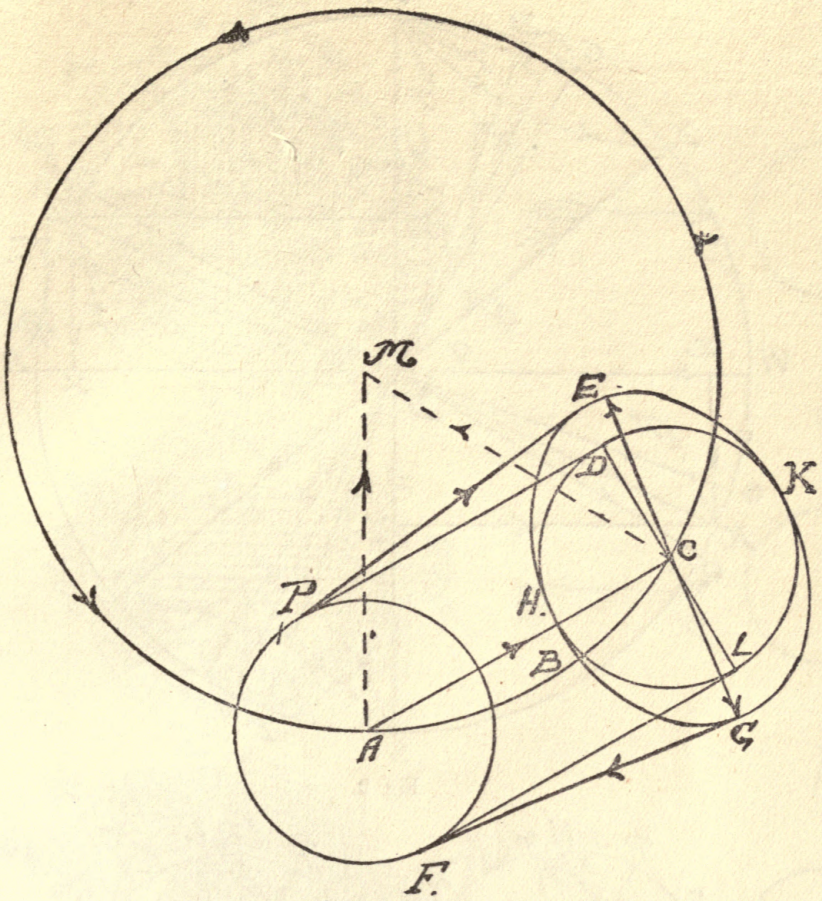
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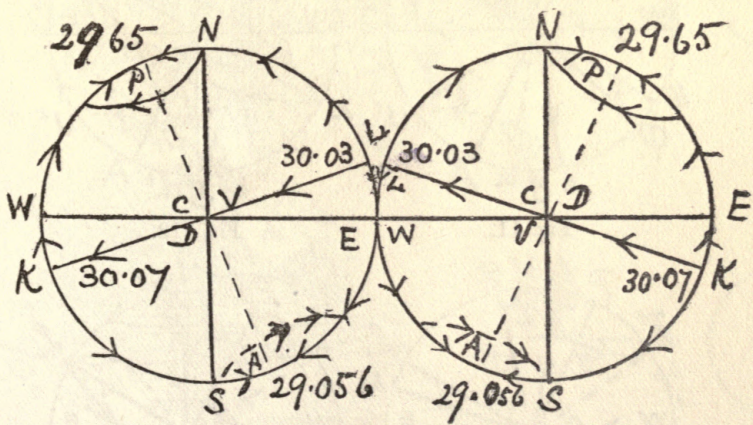
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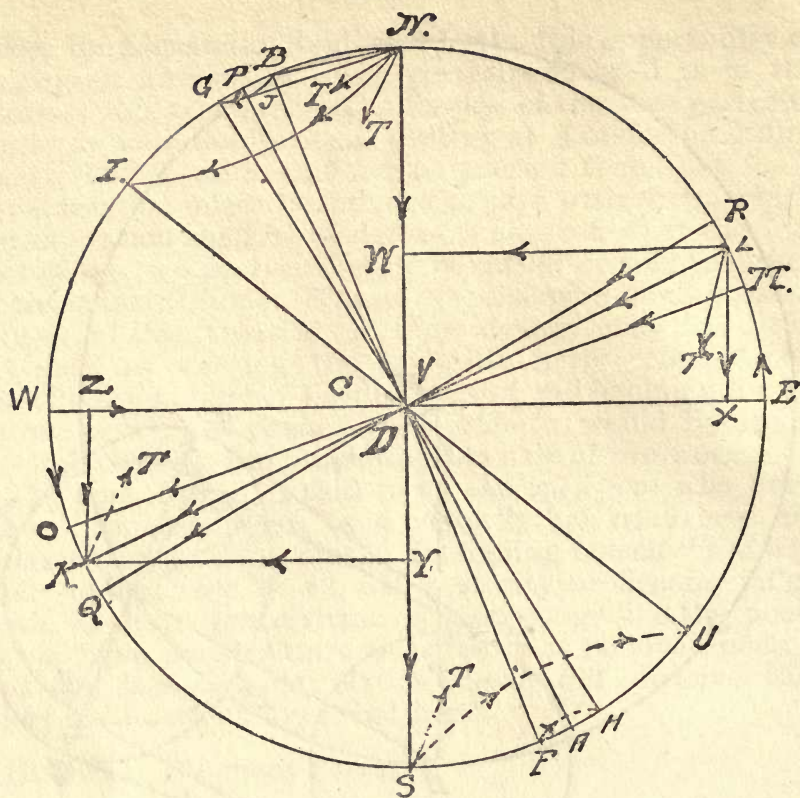
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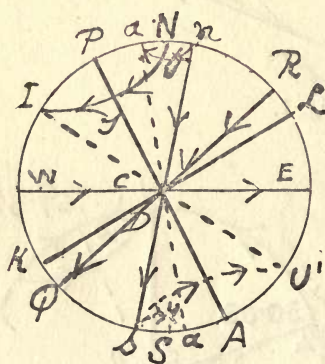
Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 7.

Conjunction.

Fig. 8.

Quadrature.

Fig. 9.

Opposition.
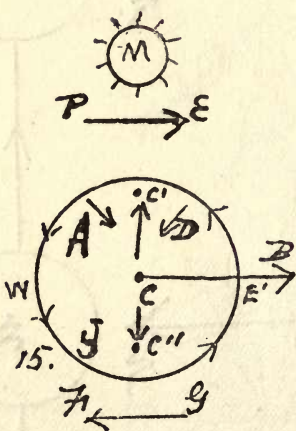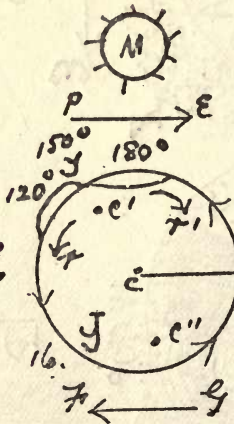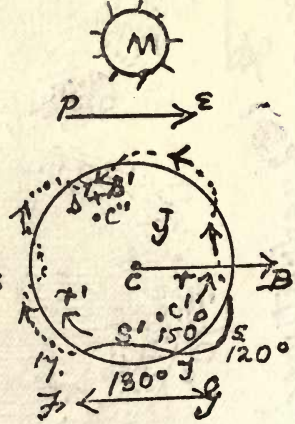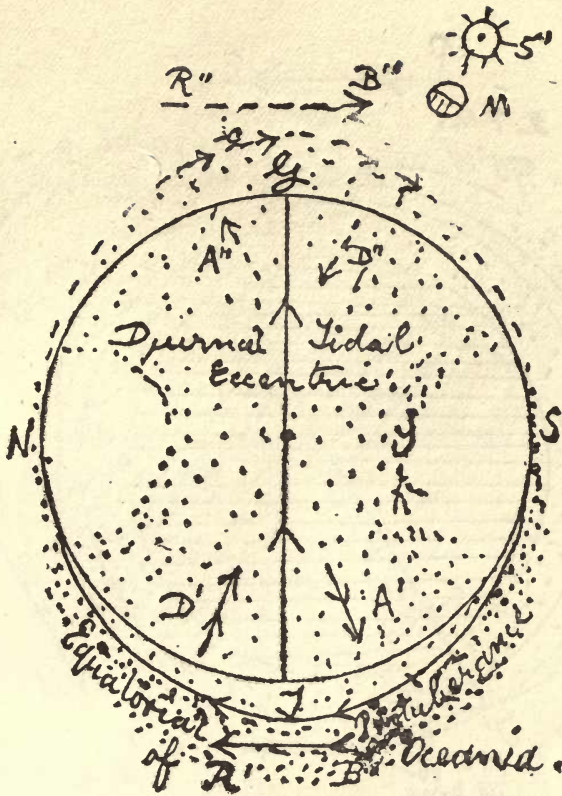
Fig. 10.

Quadrature.
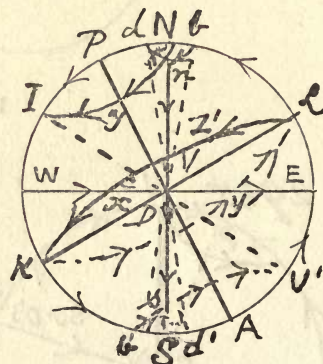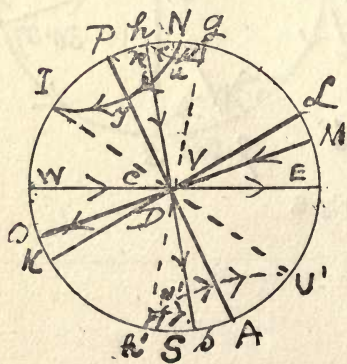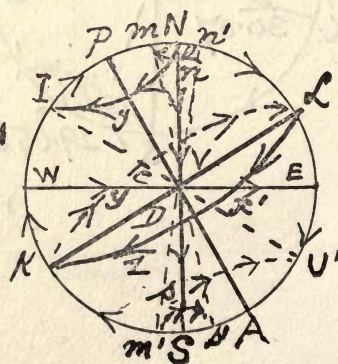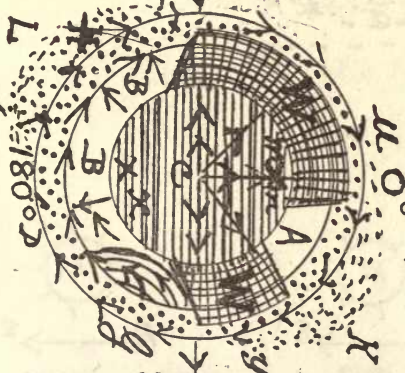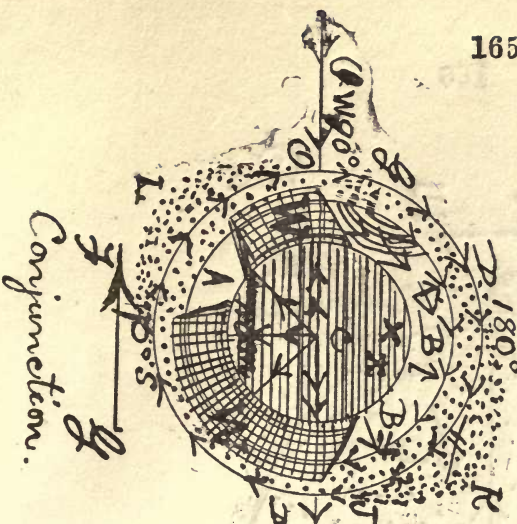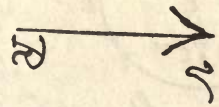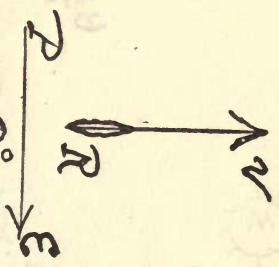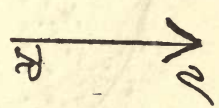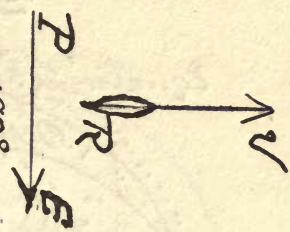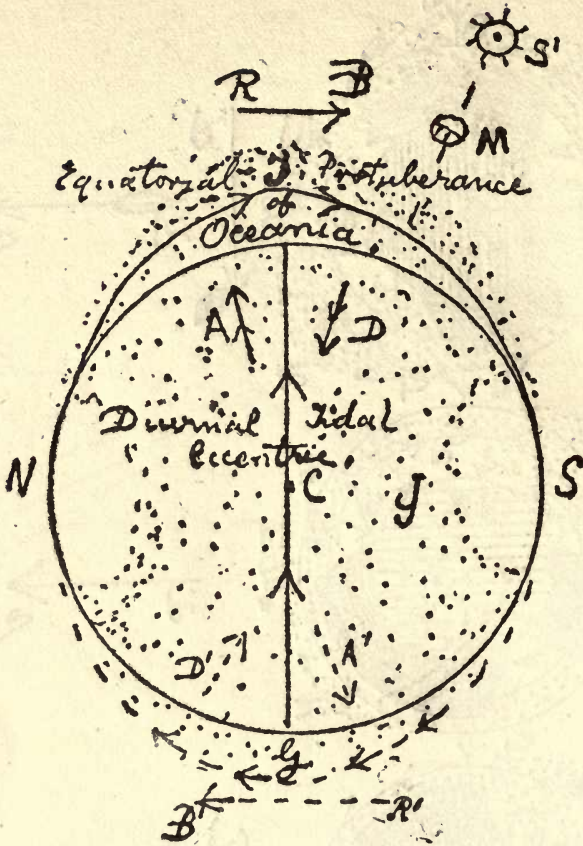
Fig. 21.

Fig. 15,   Fig. 16,   Fig. 17.
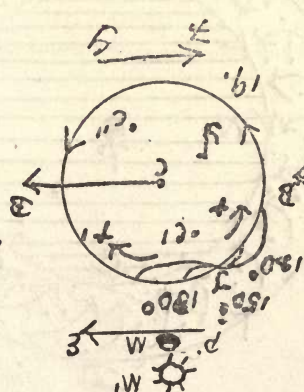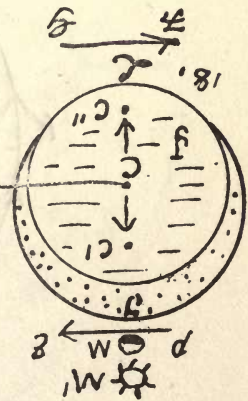
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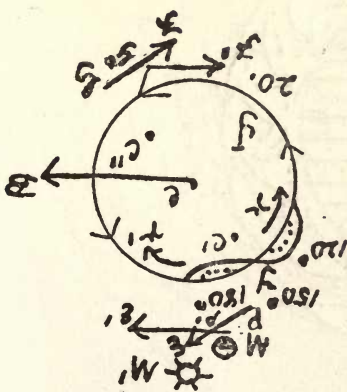
Fig. 18.

Fig. 19.

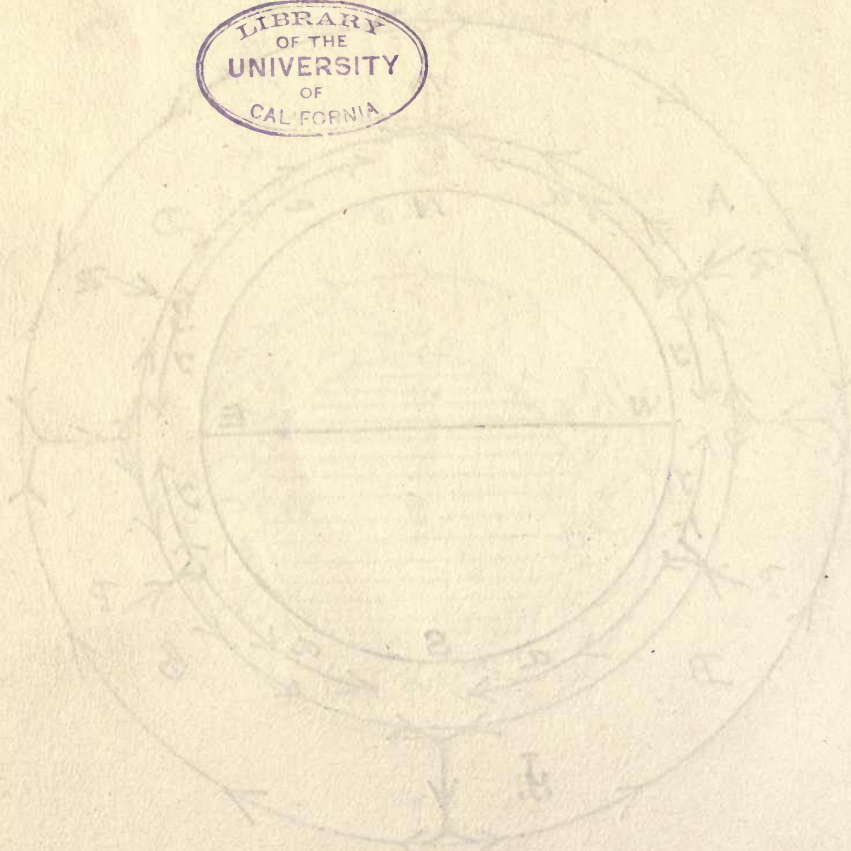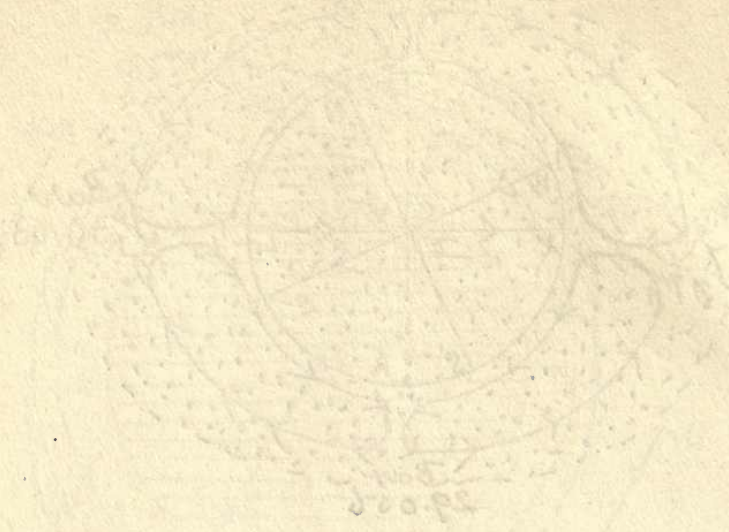Fig, 20.

ROBERT BURNS, Scotland's Greatest Poet.

From an original portrait by HENRY RAEBURN, Scotland's greatest portrait painter.   Painted
    Edinburgh in the 29th year of Burns' age.   The original portrait is in the possession of the Autl
    of this "Treatise."   This portrait, now published for the first time, A.D. 1903, is the copyright
    the Author.   It shows Burns at his best, and before the Edinburgh coach accident had marred
    visage.   It is a beautiful face with almost superhuman eyes.   The hair is lank over the forehea
    the style in which Burns usually wore his hair.   This is the "Henry" portrait of Burns referred
    in Letter xxxix., Clarinda to Sylvander, under date February 7th, 1788, the day following
    exchange of portraits between Burns and Clarinda.   The ultimate destiny of the portrait, as a
    that of the REID portrait, appears to have been that it passed into the possession of Elizabeth Pat
    or Elizabeth Paton Burns, with whom Burns appears to have retained a life-long friendship, and
    whom he appears to have sung as his "fair Eliza."

JOHN JONES, AT AGE 35.

The discoverer of the only two original portraits of Burns which agree perfectly in their likeness (that by RAEBURN and that by ALEXANDER REID), and therefore must take the first place among the portraits of that illustrious poet ; and the Author of this Treatise, "A Kinetic Universe," embracing the "Gravitational or Perturbation Theory of the Atmospheric Circulation," "Subordination of the Precession of the Equinoxes and Nutations of the Earth to the Movements of the Atmosphere, Ocean, and Fluids of the Globe," and a "Gyrational and Kinetic Theory of Gravitation," &c., &c., &c. See Index of Treatise. J. JONES regards the above as his best portrait, and a portrait at his best. Born on the abutments of the Iron Bridge at Benthall, Broseley, Salop, February 5th, 1851.

WILLIAM JONES, AT AGE 49, AND MARIA PALIN JONES, AT AGE 49,
OF BROSELEY, SHROPSHIRE, ENGLAND.

The parents of JOHN JONES of Benthall, Broseley, the Author of this Treatise, "A Kinetic Universe," in which is displayed "The Gravitational Theory of the Atmospheric Circulation," "The True Cause of the Ocean Tides and Currents," and "The Gyrational Theory of Gravitation," &c., &c., &c.