

Glenn (James)

THE

REAL NATURE OF THE
ELECTRIC FLUID;

EXPLAINED AND ILLUSTRATED BY NUMEROUS FACTS, AND A
CAUSE ASSIGNED FOR THE POLARITY OF THE MAGNET.

A NEW EDITION, IMPROVED.

To which is annexed,

A THEORY OF THE

TIDES AND CURRENTS OF THE OCEAN.

BY JAMES GLENN,

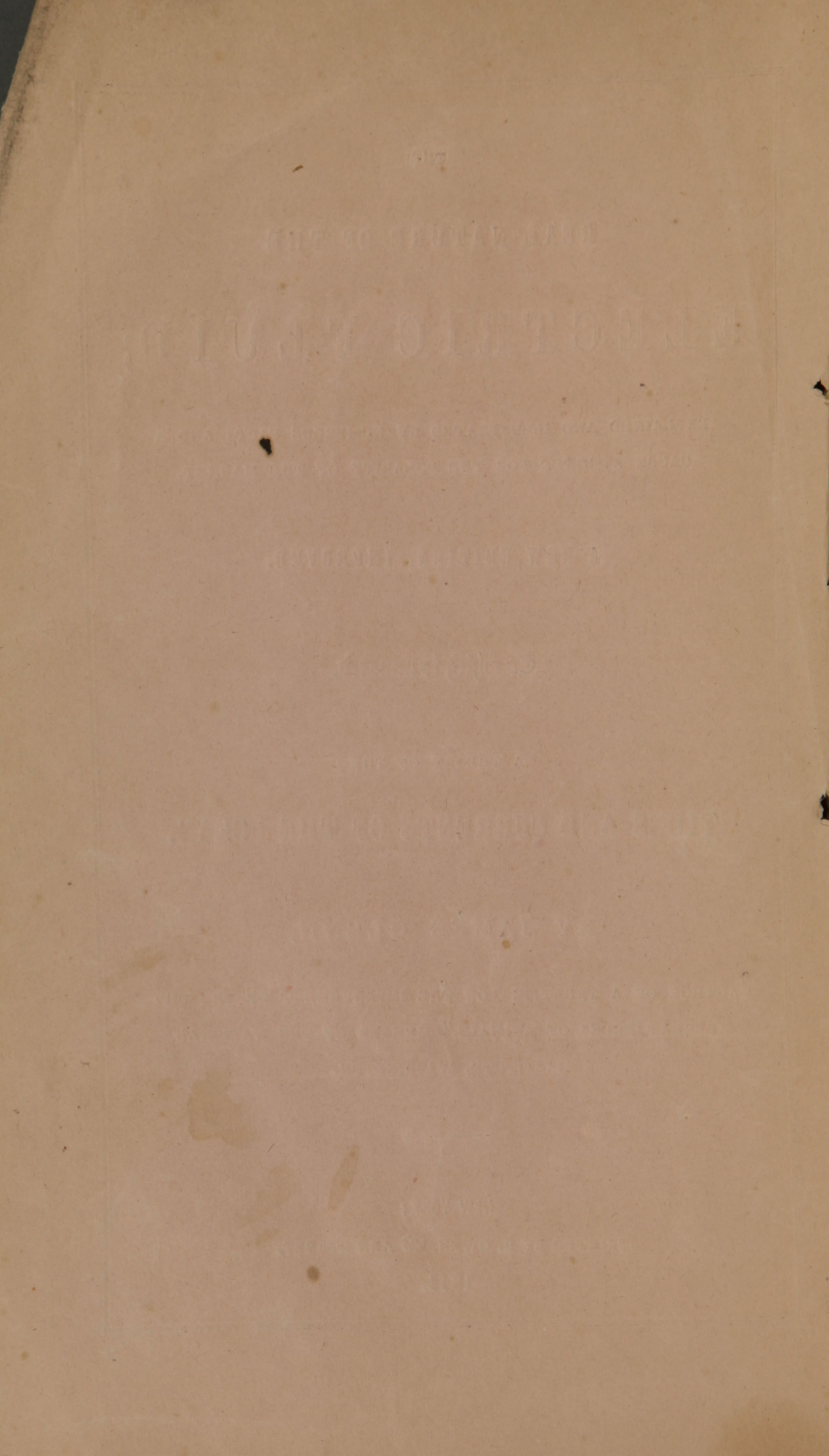
AUTHOR OF A TREATISE "ON THE IMPROVEMENT OF THE DIFFERENT RACES OF ANIMALS." MEMBER OF THE NATIONAL INSTITUTE, WASHINGTON.

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PRINTED BY B. OWEN, 29 ANN STREET.

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NEW YORK

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Entered, according to Act of Congress, in the year 1844, by James Glenn, in
the Clerk's Office of the District Court of the United States, for the Southern Dis-
trict of New York.

P R E F A C E .

It is now more than three years since the Author published the first edition of this pamphlet, and he has now the satisfaction of saying, that the great majority of persons who have read the treatise, have concurred entirely in the Author's views respecting it, as being the most plausible and rational theory, that they have ever read or heard of; and they have expressed themselves so to the Author in the most cordial terms. It has indeed met with opposition from a few persons, who, from motives of interest, preconceived notions, and obstinate prejudices, are opposed to every thing that is new. This opposition was to be expected, as it has been experienced by almost every original writer or inventor, in every age of the world. This is a trait in human nature,—it is characteristic of the animal—and will probably always remain so, until human nature is changed.

The theory of the Tides that is here advanced is entirely new and original; and we are not aware that the cause here stated, has ever been dreamed of by Philosophers: and this is the more remarkable, as the operation described is very simple, and one would think might have readily occurred to any ordinarily studious person.

It was our intention to have published a larger treatise on the subject, but the difficulty of obtaining correct information on some particulars, has induced us to present it to the public in the same form, without alteration or addition, in which it was written, more than two years ago. And it is with no small degree of pleasure, that we are now enabled to lay before an intelligent community, the most satisfactory and rational explanation that has yet been given to the world, of two of the most remarkable phenomena that occur in the operations of nature.

ELECTRICITY AND MAGNETISM.

It is a pleasing feature of the present age, that the road to science, is open to all mankind, who have the means and the inclination to pursue it, and no superstitious enactments interpose, to prevent the diligent investigations of the laws of Nature. But although this is the case, there are still some people who would invest several of the operations of Nature with a mystery, which they say is presumptuous, for any one to attempt to unfold, and there are others again who would designate some of the laws of Nature as a peculiar emanation from the Deity that he never meant should be revealed to mankind. This mode of reasoning is certainly very preposterous, as it may be the means of deterring individuals from prosecuting researches that might otherwise have terminated very successfully. There are no objects or operations of nature that ought to be considered above the comprehension of Man, he ought rather to be encouraged to proceed, and to examine everything that presents itself, however intricate or awful, and difficulties may at last give way, and discoveries be made of which he had not previously, the least idea. Such has been the case with the two subjects, I am now about to discuss; the qualities of the Electric Fluid, have been denominated by such individuals, a subject destined to be for ever hid from the gaze of man. And the Magnet has been termed a direct gift from the Deity without having any positive cause for its directive qualities.

The first occurrence that directed my attention to Electricity, was the well known circumstance of milk becoming sour during a thunder-storm, although quite new, and perfectly sweet but a few minutes previous. This fact led me to consider the Electric Fluid, as an extremely subtle acid, and that during a thunder-storm, it is generated or evolved by the decomposition of a number of gases or vapors, that have exhaled from the earth and have collected in the atmosphere, during warm weather.* Although I entertained this opinion for a number of years, I did not reflect much about it until very lately; when reading some ac-

* It is somewhat singular, that although Chemists were aware that Electricity was produced during the decomposition of matter, it never led them to suppose that it might be evolved by the same, or similar means in the atmosphere, during a thunderstorm, such as the decomposition of different vapors or gases. In the case of a Galvanic Battery, we are induced to think, that the Electric Fluid is produced in that operation, by the decomposition of the Metals, through the action of the acid, and Electricity is evolved and conducted off by the wires. Should this be found to be the case, it will be some proof of our theory, that Lightning may be produced, by the decomposition of any kind of matter, and that in this operation, Art but imitates Nature.

count in the newspapers of thunderstorms, and the circumstance of lightning striking some trees, more frequently than others, it attracted my attention, and on making minute enquiry of a great number of individuals who had witnessed the effects of Lightning on trees, I learned that it very seldom injured Beach, or Maple, and that its effects were very fatal on Pine and Hemlock, and that they are the kind most apt to be struck. From these facts I inferred, that as Acids, and Alkalies unite, and form neutral salts, and have an affinity for each other, and that as Beach and Maple contain Alkaline salts, or Potash, this was one reason why the Electric Fluid, having an affinity, for those substances being an acid did them but little injury, as it renders them good Conductors, while the Pine, and Hemlock, being of a resinous nature and of course bad conductors, or in other words substances for which the Lightning has no affinity, or but extremely little,—are shattered to pieces, and large fragments of the trunk are often thrown to a great distance. Oak Trees are also very apt to be struck, and I have found on inquiry that the wood of Oak gives but very little ashes, although there are some in the bark of considerable strength. These facts tended strongly to confirm the definition I had given of the Electric Fluid, and my belief was further strengthened by considering other points of resemblance. Carbonic Acid gas, although it exists in large quantities in Nature uncombined, it is yet produced by fermentation, whether acetous or vinous, and who knows but that the Electric Fluid, of which we are speaking, may be produced by a similar commotion of the elements, such as the decomposition of different gases in the atmosphere? The former operation destroys all crude indigestible matter, rendering liquids wholesome and beneficial as a draught; and nutritious, nourishing substances, as wheat flour, palatable and of easy digestion; and the latter process purifies the air, rendering it cool, refreshing, and invigorating after sultry enervating heat. I do not give these last remarks from a conviction of their certainty, and indeed they may appear to some people too fanciful, they have however, some appearance of probability—and if it were the case, it would develop a beautiful system of nature; that when the atmosphere we breathe gets so contaminated and corrupted, by different exhalations arising from the earth in very warm weather, it is cooled, and purified by a process similar to that we cause to be performed in the baking of bread, and without which the most nourishing substance in nature, wheat flour, would not be fit to eat; and although an agent is exhibited in both cases, (when it operates on a large scale,) that it is fatal to life—Carbonic Acid Gas, and the Electric Fluid—yet the evil is but partial, while the benefit is universal.

There is another analogous circumstance subsisting between Acids and Electricity; and that is their penetrating qualities. Acids are the most insinuating of any other substances that I

am aware of; they will corrode or consume almost every thing with which they come in contact; there is hardly any vessel that will contain them, excepting those made of glass,* and the precious metals, and they act very readily on iron, forming salts. This similarity between them and the Electric Fluid is very striking, for glass is a non-conductor, while iron, and all ferrugineous bodies are the very reverse. If the term affinity were applied in treating on Electricity, instead of the terms conductors and non-conductors, or electrics, and non-electrics, it would apply equally as well, although for all the difference it would make, there is no necessity for changing the terms. The electrics are those for which the fluid has no affinity, and the non-electrics are those for which it has an affinity.†

The Electric Fluid appears in different degrees of intensity. Lightning is its highest or most accumulated state, with the exception of the body of the Sun, which I have no doubt is a vast body of accumulated Electricity in an intense degree; but I will notice this hereafter. That condition of it, excited by the Galvanic Battery and Electric Machine is its next; and it exists in all ferrugineous bodies; and particularly in the loadstone, in the lowest state in which its agency can be exhibited. In all these states, I am convinced it is one and the same fluid; and there can be no doubt that it exists in a very latent and diffused state all over the atmosphere and the earth. But this I will explain when I come to speak of the Magnet. These at different states have been termed the *positive*, and *negative*, and some philosophers suppose that there is a *vitrious* and *resinous* kind of it. If they mean by this, that there are two distinct fluids, I must beg leave to differ from them; for I am inclined to think, there is only one kind of it, and that it is a simple elementary substance incapable of change, or being decomposed; but still exhibiting different appearances of color according to the mediums through which it passes; and assuming various conditions, and performing different operations, according to its degree of intensity. There are various ways that Electricity may be accumulated. *First*, by the decomposition of different kinds of substances, whether solids, fluids, gases or vapors. The lightning in the atmosphere may be taken as an instance of this operation, as it is doubtless produced by the decomposition of different vapors that have exhaled from the earth: and this is effected by their qualities being adverse, and the one destroys the other, in the same manner as the acid in a Galvanic Trough

* The Fluoric Acid corrodes glass only when in a wet state.

† The word non-conductor, applied to Electricity, is only a relative term, and is not to be understood in the strict sense of the terms, for all substances conduct Electricity in a certain degree. Imperfect conductors is a more accurate term, as for instance, wax, and glass, conduct less than iron, or any kind of metals. If the fluid is highly accumulated, it will not pass through the two former, but will shatter them to pieces. There is hardly any accumulation of it that will not pass through the latter, although it sometimes fuses them.

acts upon the metals, by decomposing a portion of them. The only difference in the operation is this, that gases are more easily decomposed, and their whole volume is destroyed at once. *Second*; by friction of bodies, such as the Electrifying Machine, and some fish have an internal electric apparatus, that accumulates it. Philosophers do indeed say, that lightning is produced by the friction of the clouds, and that the fluid passes from the one to the other on account of their being differently charged, one positive, and the other negative. We cannot perceive why vapor of which a cloud is composed, can be said to rub together, or even water which is a much denser fluid than any portion of a cloud; it requires a hard, solid substance to produce Electricity by friction.

I am aware that philosophers have drawn a distinction between Electricity and Magnetism, and ascribed them to the agency of two different fluids; but this I am satisfied is a mistaken idea, which I shall have occasion hereafter to explain. Although the Electric Fluid in an accumulated state, such as Lightning, or that condition of it acquired by the Galvanic Battery—has a powerful heat, so much so as to fuse metals by merely passing over them instantly; it is yet in its natural state, a cold fluid, or to speak more correctly—the same fluid that imparts heat when highly condensed or accumulated—may become so diffused as to excite the sensation of coldness: and as Electricity is known to enter into the composition of every thing, and to exist everywhere, in cold bodies and situations, as well as warm the assertion involves no inconsistency, that the same fluid may be both hot and cold. It is well known that there is more Electricity in the atmosphere in cold countries, such as the polar regions, and in cold winter weather in temperate climates, than there is in torrid climes, or in warm summer weather in mild countries; and it is easier to accumulate the fluid by friction in the former situation and season, than the latter. The above remarks will assist us in explaining this circumstance. Electricity is produced in great abundance in warm weather and hot climes, by the decomposition of so many substances caused by excessive heat, which is no doubt the cause of our severe thunder-storms, while in the polar regions there are none at all; as there is nothing decomposing, nor no pestilential gases generated. In the former situations, the Electric Fluid is always combined with other gases or fluids, and does not exist, or cannot be accumulated pure, but with difficulty; as for instance, the heat of a fire in a warm room, is always more or less charged with the qualities of the fuel decomposing or consuming. In the latter situations it exists in a purer state, being more free from gases or vapors, and is therefore more easily condensed by friction. A question may be asked here, why is it, that the Electric Fluid does not warm the atmosphere in those regions, if there is more of it? To this it may be answered,

that there is more of it pure, only; and that Electricity cannot be a substance imparting heat so long as it is in motion and diffused, but the moment it is accumulated and fixed, as is the case with the Sun, or bodies in the act of decomposing as fuel, it imparts heat.* Could a volume of Electricity be collected and condensed in the polar regions, there can be no doubt but that the earth would be considerably ameliorated in its vicinity. I may remark here, that the friction of bodies elicits Electricity, but the fluid is not taken from these bodies, or only in a small degree,—that is if they are Electrics, the greater part of it is taken from the atmosphere; but of this we shall have occasion to speak hereafter.

We will now proceed to state the principal part of our discovery, which we think will corroborate a great part of what we have already advanced. In the summer of 1839, I wrote an article on the origin of vapor, or mist, which was published; but on subsequent reflection, I perceived that it was egregious folly in me to write anything about the weather, the results were so uncertain, and the laws which regulated the weather, I supposed, were not uniform and of course could not produce uniform results, or to speak more correctly, “Although the weather may be governed by certain laws, yet the time requisite for ascertaining their true nature is so great, that it is far beyond the comprehension of a single individual, and cannot be comprehended during a lifetime.” A severe storm might happen at one time, and might not occur again at the same place for ten or twenty years. A hurricane might sweep over a devoted village, and such an event might not again take place at the spot for an age. A simple peasant knows more about the weather in the district of country in which he resides, than the most acute philosopher could do that ever lived. The generality of people know something about the average kind of weather, but when there occurs an exception, all classes are at fault with their predictions.” It was from reasoning in this manner, that I concluded to turn my attention to some study that was regular in its operations. It then occurred to me that the Needle, which points to the North with so much regularity, must be governed

* I have written a Manuscript on philosophical subjects, which treats principally of the real nature of Light and Heat, on which I have lectured in different parts of the country. I think I have clearly shown that Light and Heat is identical with Electricity; this has been supposed by some philosophers—but I have clearly traced the connection, and have clearly shown the real cause of Light and Heat of all kinds. I have not room for entering into details in this pamphlet, as it is my intention at a convenient season to publish the Manuscript; but I may remark here, that I have given good grounds for believing that “the Sun, is a vast volume of white, fixed, Electric Fluid, of great intensity, and that the highly rarified state of air in which it is placed, prevents its escaping or dispersing.” I have shown it to be identical with the body of Electric Fluid, that it is evolved from the clouds in the atmosphere during a storm; and could we fix the body of Electricity in that position, the moment it was evolved, it would be a sun in miniature; and it would impart both light and heat the same as that luminary. But we cannot fix it in our dense atmosphere, there are so many substances to allow it to escape.

by an uniform and unvarying law, and notwithstanding it had baffled philosophers for ages, it was yet possible to find it out. I then resolved to make some experiments upon it the first leisure time I had to spare. Time however passed on, until reading a work of Mullinger Higgins', in an article on Magnetism, I was surprised at finding the following remark: "Poles," says he, of the same name repel each other, and opposite ones attract," and he adds, "It follows that we have misnamed the Poles, that which is directed to the North Pole of the Earth, is the South Pole of the Magnet." This contradiction in terms amused me, and after reflecting some time on the habits of the Magnet, I imagined what I consider to be the real cause of the directive powers of the Needle, or Magnetic influence, and it is this. There is an universal current of Electricity passing all over the face of the earth, from the extreme South to the North, and the Needle possessing naturally a larger share of the fluid, lays itself in the direction of the current, and the current passes through it. As soon as this idea flashed across my mind, I became convinced that I had hit upon a most important idea; an idea that would explain a great many of the phenomena attendant on the Magnet, and render everything relating to it perfectly simple and easily explained; subsequent observation and experiments have fully confirmed me in the correctness of my views. On examining the work of Professor Olmstead, of Yale College, I found that every experiment detailed by him concerning the Magnet, completely verified the idea I had conceived above, a few of which I will now detail.

It is well known that Poles of the same name in a Magnet repel, and opposite ones attract, and the reason of this will now appear very obvious. Because the current of Electricity entering at the South, and passing out at the North end, oppose each other, that is, they are passing in opposite directions. If the North or Boreal point of the one is reversed, and laid against the Boreal point of the other, the two currents would be meeting each other from the habit that the Magnet had acquired—and the one that was reversed would very soon lose its power, or have its poles reversed. Upon the same principle then, take the South pole of the one, and place it against the North pole of the other, or in front of it, and they will attract each other, because the current is then blowing in its natural direction, that is, it is passing out at the Boreal point, and entering the Austral. If a Magnet is broken into different pieces, each part will be a perfect Magnet of itself, having a South and a North pole. This I consider a strong presumption in favor of a current, if not an actual demonstration of it; for it is evident that wherever the current passes out, is its North point, and where it enters, its South point; and this will be the case wherever a fracture is made.

The prevailing opinion seems to be that there are two fluids in

a Magnet, ("The Austral and Boreal,") but the fact stated above with regard to the breaking of a Magnet, seems to have confounded some philosophers, for it is natural to suppose according to their doctrine, that breaking a Magnet in the middle, and taking away the Austral half, there would only be one South pole left, or in other words it would be no longer a Magnet, its Magnetic influence being destroyed. Philosophers explained this circumstance by saying that the two fluids are in very minute divisions; an explanation that appears to me very unsatisfactory. I have found it to be an invariable result, that where the fluid or current enters into a Magnet, that end is its South point, and where it passes out, its North, and this is the case with a great many conducting substances, and even round balls of iron have a tendency to Poles, or to direct themselves North and South. We will here add an extract from Professor Olmstead's work, verifying the remark made above. "If the North Pole of a Magnetic Bar be placed upon the middle of an iron bar, the two ends of the latter will have North Polarity, while the part of the bar immediately in contact with the Magnet receives South Polarity; and if the same North Pole be placed on the centre of a circular piece of iron, all parts of the circumference will be endued with North Polarity; while the plate will have a South Pole in the centre;" see further examples in Professor Olmstead's work. In these cases here stated, where the current enters, is its South point, and where it passes out (although at the two ends of a bar, or through the whole circumference of a circle or star,) its North part.

Lightning is said to affect the Needle, and when struck by it, it sometimes destroys it and at other times it reverses its Polarity. It also very frequently Magnetizes pieces of iron, and the same power that destroys a Needle can also restore it. This seeming contradiction is of easy explanation upon the principle of a current that we have advanced. The cause of its destroying the powers of a Needle, is doubtless owing to the Lightning absorbing in its passage, all the natural share of the fluid residing in the Needle, and the reason of its reversing the direction is very probably caused by the Lightning passing in an opposite course to the current. But these occurrences are by no means common, as Lightning sometimes strikes without doing the Needle any injury, and when it is discharged, as I have already observed, the same power can restore it, for it has been frequently known to Magnetize bars of iron. In these cases it will always be found, (reasoning from analogy,) that at the point where the Electric Fluid entered will be its South end, and where it passed out its North end. And we surmise that this would be the case, whether the fluid entered in a contrary direction to the natural current, or whether it passed in a perpendicular course. The bar on being poised by the middle, would direct its end to the North where the Lightning made its exit; or if

the body were a small Needle, it would direct itself on the water, as this element is a good conductor; and it proves that the current is stronger in water than in the air, when it has force enough to overcome the resistance of the Needle on the surface of the water. All these statements go to prove, that Lightning, Electricity, and Magnetism are the same Fluid, only differing in degree or intensity, and in the quality or substances of bodies by which they are acted upon.

The Polarity of the Magnet, as it is called, or the Magnetic influence, has always been considered as constituting it a distinct fluid from the rest, but this is entirely owing to the habit or nature of iron or loadstone being a good conductor, and at the same time inheriting a considerable natural share of the fluid, which it has doubtless received from the current passing in the earth—as it is possible it passes under as well as over the surface of the globe; but we have not so many facts to support the former assertion as the latter. This then, is a peculiar property that iron possesses, and not any distinct quality of the fluid. We have often been surprised that the circumstance of Lightning magnetizing iron bars, or a shock from an electric machine, or a discharge from a Leyden Jar, was not considered by philosophers as a sufficient evidence of the identity of the fluid. It would appear from these examples that Magnetizing is neither more nor less than the passage of the Electric Fluid in an accumulated state through the iron; (this alludes only to the circumstance of Lightning or Electricity Magnetizing,) and that the current of Electricity being in a more diffused simple state, follows in the track that had been prepared for it. Lightning always darts straight forward, except when meeting with a non-conductor. when it shatters it to pieces, or takes a different direction—but never retraces its track. In order to make ourselves perfectly understood on this point, we shall suppose that the Electric Fluid or Lightning, magnetizes a bar of iron, by passing through or over it from North to South. If this bar is taken and poised by the middle, it would reverse its position; the friction of the earth rendering the current unable to do this before. But supposing the bar to be left for some time in the same state in which it was magnetized, it would either lose its properties as a magnet, or have its poles reversed, and this would be effected by the natural current, forcing its way through the bar in a contrary direction to the passage of the Lightning. It would seem then that magnetizing is merely the passage of the fluid in a slightly accumulated state through the iron, making a path as it were for the fluid in its more simple and diffused state to pass, and this is probably effected by giving the grain of the metal a slight tendency that way. But these remarks only refer to magnetizing by Lightning, or Electrifying apparatus. One Magnet it is well known, will also impart the property to another, or even a hundred, or to any

conceivable number, without any diminution of its properties. Philosophers could never explain this, as it differed from their theories of communication; and they considered this principle as constituting Magnetism a distinct principle from Electricity. But the cause of this will now appear perfectly obvious. The Magnet, as we have already stated, possesses a natural share of the fluid, in a higher accumulated state than the simple current, though not so much as that produced by an Electrifying Machine, and when an unmagnetized piece of iron is brought near it, the natural current is diverted from its direction, and both the Magnet and the iron attract each other until they come in contact; while thus adhering or placed alongside each other, the natural current is passing through the Magnet, entering the iron at the other end, which constitutes the South, passing out at the other end, and re-entering the Magnet, which causes the North end of the iron. It thus requires an accumulation of the fluid that the Magnet possessed, and also its directive qualities; and on being taken apart, it will reverse its position according to the principles I have already given. The Magnet in this case does not part with any quantity of its properties, if it does, it is instantly supplied from the current, in the same way it originally received it, and of course it may impart the quality to a hundred, or any definite number, when it has the power to renew itself, and some philosophers even assert that it is even stronger than before the operation; this however may be doubted, habit and use increase the capacity of animals, but not of inanimate objects.

This example explains two other experiments with the Magnet that have puzzled philosophers. If a magnet is placed in an unnatural position, its Boreal point towards the South, it will soon lose its directive qualities. But if two Magnets are laid alongside each other, with their dissimilar ends united, they will retain their properties; this is in consequence of the current passing through both Magnets—first into one, and then into the other, as if it were a circle as I have hinted above. Philosophers explained these two examples, by saying that the single Magnet lost its power by lying contrary to the magnetism of the earth, and the two Magnets being together, neutralized each other's properties and prevented the loss of power. I am inclined to believe that the principle illustrated above with the two Magnets—the fluid passing out of the one into the other, and being retained in that manner some time, and still receiving a supply from the natural current—explains the great secret of the amazing power of the Horse Shoe Magnet. The fluid being retained in it, and also retained in the great quantities of wire by which it is surrounded, * and being still capable of ab-

* I have never seen any reason assigned for the circumstance of people wrapping a Horse Shoe Magnet round with wire, and that wire, being also wound round with linen thread painted, and varnished. I will endeavour to assign a cause for this mode of acting, and the inference I shall draw from it, may be of some use

sorbing more from the natural current, constitutes a current or circle of Electricity that renders the Magnet difficult to be pulled away from it without considerable force. In this respect it may be compared to a piece of wood floating in an eddy, it requires considerable force to draw it from the vortex. It may be objected here by some that this peculiarity in the current passing through the two Magnets, does not accord with a remark that has been made about Lightning, which it was asserted never retraced its course, although this is contrary to its nature, yet it is very probable it may run round a circle, or what is the same thing, it may pass through one bar of iron into another that may be laying alongside of it. But the existence of Lightning in this highly accumulated state is only momentary, for it soon disperses and quickly returns to a diffused state.

We shall now explain a remark that has been already made, that Electricity does not reside in Electrics, but that it is taken from the atmosphere by friction. In all probability this is accomplished by the substances rubbed arresting the current of Electricity until they become enveloped in it, as is found to be the case with any Electrical Machine. It remains in this state some time, or until a conducting substance, such as iron is applied to it, when it passes off. Chemists and natural philosophers have considered this circumstance as establishing a difference between Electricity and Magnetism. But in fact as we have already observed, the difference is only in the bodies and in the condition of the fluid, the latter being in a higher accumulated state. There can be no doubt that the natural current of Electricity which I have supposed to exist, constantly passing from South to North, passes through all objects, Electrics and Non-electrics, in this rare diffused state. But when two bodies are violently rubbed, the current is concentrated and accumulated around the object, such as the glass cylinder of a machine; and this being an imperfect conductor, it cannot pass through it in this state, but remains in it only a short time, when it passes off of its own accord, unless a conducting substance is applied to it. Non conducting substances, then they do not retain a natural, or accumulated share of the fluid, while magnetized substances do; and this constitutes the real difference between the two kinds of bodies.

to those mechanics who make Magnets. The design of wrapping the wire round with linen thread painted or varnished, I apprehend is this. The linen thread is a non-conductor, and after being painted is more so; and after the wire is charged or magnetized by the ends that are left bare, the fluid cannot escape so readily, being surrounded with non-conductors, and the wire being wrapped round the Horse Shoe Magnet, increases its power to support weights, as it contains a greater amount of Electricity. We apprehend that this is the reason why the wires of an Electric Telegraph are wound round with tarred Hemp thread or some other non-conducting substance, in order that the Electric charge may pass through to the extremity of the wire without escaping. It would seem that in a long wire or rod of iron, the Electric charge passes from the rod and re-enters again several times before reaching the extremity, and sometimes passes from the rod altogether. This is the reason why mechanics cannot make a long Magnet, the fluid escapes before it reaches the end, and forms several sets of Poles.

These remarks will further illustrate the case of the Magnet and the Electric Fluid. The latent current in passing through the Magnet it is natural to suppose, will have a tendency rather to increase its power than diminish it, and it is equally plausible to suppose that the passage of the fluid in a highly accumulated state through it, would deprive it of all its qualities, by oxydizing or partially decomposing it; and it also follows from both these conclusions, that the passage of the fluid in a slightly accumulated state through the iron, would also magnetize it.

I have been sometimes asked the following questions, which I will endeavor to answer in their order:—

First: “What authority is there for supposing that the current of Electricity is always passing to the North? Is it not just as likely that it may be passing from North to South?”

I answer:—“This question has been already answered, for it is evident from the habit of the Needle itself reversing its poles, when the North end is turned to the South, which evidently shows that the current is passing towards the North, or it would not reverse its poles. If a piece of iron is magnetized by an Electrifying Machine, or Leyden Jar, or any others means, it will uniformly be found that where the fluid entered is its South end, and where it passed out its North, another conclusive evidence of the statement made above.”

Second Objection:—“If the Needle is held in one direction by an universal current of Electricity, what is the cause of the Needle being deflected when placed under a current passing from a Galvanic Battery? One would suppose that it ought to run parallel with it, or that the Needle ought to point in the direction of the current.”

Answer:—“If the Needle is placed in the circuit of the current, it will point in the same direction; this fact is well known—from this it may be inferred that the cause of its being deflected is owing to a superior, and stronger artificial current passing above or below it, (as the case may be) than the natural one, and being outside or on the margin as it were, of the current, it causes it to deflect, just as small light objects may be impelled from a current of wind towards its margin, instead of being carried along with it.”

Third Objection:—“But how came this current to pass always in one direction, and how is it supplied?”

Answer:—“There are a great many of the laws of nature that we cannot account for in any other way than by saying that they were established so by the Almighty; there are some indeed that may be discovered and their true causes explained, but we always arrive at a point that is inexplicable; with regard to the supply of the current it may be remarked, ‘that nature is constant and perpetual in her operations, suffering no waste, and requiring no supply; there is nothing new created,

nor nothing lost.' There is probably not one particle less Electric Fluid in the universe since the creation. There is indeed more of one kind of matter existing at one time and place than there is at another, but upon the whole there is nothing lost or gained."

It may also be a subject of enquiry by some persons, what becomes of the Electricity that is constantly passing over the face of the earth towards the North? This may also be a difficult question to solve; it may return through the crust of the earth at a great depth to the South thus again to continue its perpetual round, or it may be converted by some operation of nature into another element, and return in the same way to be resolved again into its former fluid. These last remarks are only given as mere conjectures, which any person is at liberty to reject or accept as may best accord with his own judgment. There is always some ultimate cause that we can hardly hope to explain. The dip of the Needle towards the North would seem to indicate that the current has a tendency downwards, and its getting almost vertical there, gives a strong coloring to the above supposition; while towards the extreme South the Needle rises in proportion as it is depressed towards the North, which would seem to indicate that the current there rises. These are all the arguments I have to support the above supposition. However this may be the case, there are good reasons for believing that Electricity is much more abundant in the Northern Regions than any where else, and that the Aurora Borealis is nothing else than Electricity having accumulated there in great abundance, in consequence of the current setting in that direction.

Another question will naturally arise in the minds of many—why is it, that the Thunder is not caused in consequence of the great accumulation of fluid in that region? This is a question that we hope to be able satisfactorily to answer; and we consider it of some importance, as it will tend strongly to confirm the statement we have twice already made, viz:—that Lightning is generated or evolved, and that in temperate or warm countries, and in mild and hot weather; and that no part of the Electricity in the atmosphere is taken to form it; we have never heard or read of a single instance of a thunder-storm occurring in what is called the Polar Regions; and if such a circumstance never occurs where there is such an abundance of Electricity in the atmosphere, then it is conclusive evidence that the amount of it in the atmosphere does not go to form the thunder-storm, but that it is produced by the collection and consequent decomposition of various kinds of vapors or gases in the atmosphere. A thunder-storm most generally occurs in warm weather; and it is well known that the atmosphere contains more pestilential vapors at these seasons than at any other; Earthquakes and Volcanoes are attended by thunder and sometimes only by light-

ning. But in most cases, a low, dense black cloud appears above the spot where the action is taking place, from which proceed vivid flashes of lightning. Now is it not likely that this cloud is a collection of gases or vapors, proceeding from the crater of the Volcano, or is emitted invisibly from the earth, previous to an Earthquake, or during its continuance? We all know the strange and powerful effects produced chemically by the union of oxygen and hydrogen gases, and what may not be expected from a cloud, formed by the union of all kinds of noxious gases, and sulphureous emissions from the bowels of the earth?

Some people may enquire the reason why the Electric Fluid is not more abundant in warm countries in consequence of matter decomposing, than there is in cold ones, which is well known is not the case, for the magnetic influence is much stronger towards the North than any where else. But the reason of this is very obvious; the air is so impregnated with noxious vapors, that the Electricity existing there is combined with them, and less of it exists in a simple state, while in severe and cold countries it approaches nearer a simple state, and is not contaminated by noxious vapors, and hence it may be more easily collected by an Electrifying machine. It is probably owing to this very circumstance why an Electric shock, or an accumulation of Electricity passes through us, or through any substance with such facility. It is then we think, quite reasonable to suppose, that as Electricity is very scarce in hot weather, a thunder-storm is an effort of nature to supply the deficiency; that as in these seasons of extreme heat, more noxious vapors are produced, it is from this source that it is principally supplied; and that nature in thus acting accomplishes two very beneficial purposes, by destroying pestilential exhalations, and by imparting a cooling and refreshing influence to the air we breathe.

Some people who are not conversant with the principles of Electricity, will hardly conceive it possible that there exists in nature a fluid so subtle as to be capable of passing through all objects in existence when in its simplest state, and to be incapable of being dissipated or impaired by wind, rain, hail, snow, or any agent in nature with which we are acquainted: and it is equal in velocity to light, and equally rare—and perhaps it is the most subtle fluid in nature. Such people may have their doubts lessened on this subject, by considering that a shock from an Electrical Machine has been known to pass through very many objects the distance of four miles, without any perceptible interval of time; and in all probability it might pass through the earth from end to the other in one second of time. The Aurora Borealis may be taken as an instance of its motions, which is doubtless the fluid in an accumulated state. The rarity of Electricity will not surprise Chemists, for they get acquainted with invisible substances. Hydrogen Gas is invisible, and is

fourteen times lighter than common air. There are even some liquids that are invisible; Muriatic Acid, if pure, cannot be perceived by the naked eye, and although its density may be sensibly felt by the hand when contained in a glass vessel, yet it may be poured from one bottle to another without being perceived by the naked eye. From a consideration of these facts, the rarity of the Electric Fluid will cease to be an object of wonder; but it is probable, that its velocity is not so great in its simple natural state, as when it is accumulated, for the rapidity of its motions may be owing to its haste to return to its natural state, as we find that all acids, and some other substances, are more quick in their motions when concentrated, and more difficult to be retained, than when reduced and simplified.

Although I have endeavoured to prove that the Electric Fluid is a subtle acid, yet it is only in its accumulated state that its properties can be traced. It could not be expected, that in its simple and diffused state, its acid properties would be perceptible to our gross senses. It would be a strange anomaly in nature were we surrounded by an atmosphere, tainted by a peculiarity, that were constantly present to our senses. Chemists have considered Oxygen as the principal agent in supplying acidity, but we think it may with greater propriety be assigned to Electricity; and that all acid fruits are assisted in their production by this agent. We shall now conclude this part of the subject by repeating the principles that we think we have established.

First—We have made the following subjects appear very probable by acknowledged facts, viz:—"That the Electric Fluid is a very subtle acid, that it is generated or evolved in the atmosphere during a thunder-storm. That the friction of bodies does not generate Electricity; that it is merely the Electric current arrested by that mechanical operation; that Electricity and Magnetism are owing to the same cause, the only difference consisting in the nature of the bodies by which the fluid is acted upon."

Secondly—We think we have fully established [the following principles, at least as far as this can be done by any means short of actual demonstration, viz:—"That there is a latent current of Electricity constantly passing over the whole face of the earth, from South to North, and that the Needle, or Loadstone, possessing a natural share of this fluid in a more accumulated state, lays itself in the direction of the current, which is the cause of its directive qualities; and that its poles or ends are owing to the entering and passing out of the fluid—that end where it enters, being invariably its South end, and where it passes out, its North." It follows from this, that the theory of the earth being a Magnet with poles at each end, is a mere chimaera of the imagination, and has no foundation in reality—a subject on which we will make a few remarks in the next chapter.

TERRESTRIAL MAGNETISM.

It is a remarkable circumstance, that although philosophers have entertained the opinion for several hundred years that the earth is a Magnet with two poles, yet they could never form a consistent hypothesis concerning it, and very often contradicted themselves in the very terms that they used—that is when it was proposed, as explaining the directive powers of the Magnet. We will take the liberty in this place, of indulging in a few remarks concerning their various conjectures on this subject. As it will be some gratification to us for the torrents of abuse with which (when very young,) we were assailed for what was termed our hardihood in presuming to oppose the systems of learned philosophers—as we were always very skeptical on these subjects.

We are not certain, but we believe it was Gilbert, an English philosopher with whom the idea originated, “that the earth is a Magnet, and that the Polarity of the Needle was due to the magnetism of the earth;” the word due is rather a vague way of accounting for the connection between the earth and the Needle; for the latter is elevated above the former, and some connection ought to have been made to appear. But there was another incongruity which the philosopher was aware of, and which he endeavoured to explain, viz:—“Poles of the same name repel each other, and opposite ones attract,” and of course the end that points to the North, could not be attracted by the North pole of the earth. The philosopher explained this contradiction by substituting another—“The pole of the Magnet, (he says,) that points to the North pole, is its South pole, and the one that points to the South is its North pole.” This is not giving names to things significant of their natures, but entirely the reverse. But notwithstanding all these incongruities, this supposition has been adhered to until the present day. And a late author, Mullinger Higgins, Professor of Natural Philosophy in Guy’s Hospital, England, who wrote in 1837, feelingly laments that justice had not been done to the name of Gilbert, for that among other things, he had accurately designated the names of the Poles.

But the location of the Poles at the ends of the earth, soon became an object of learned disquisition. One philosophic person would display great talent and profound erudition, in locating the pole at one place, while another would soon afterwards exhibit great tact and ingenuity in displacing it, and at the same

time, give clear and cogent reasons for locating it somewhere else. Others again imagined that the Poles were under the earth, whilst others believed them to be above; and in this way some wise head would rob another of his halo of glory; yet they all contrived to come in for a share of immortality—the only reward which many of them received for their trouble; but amidst all these conflicting opinions, a great philosopher M. Biot comes to the solution of the difficulty. Professor Kraft of St. Petersburg, also undertakes the same examination—and while the whole philosophical world was on tiptoe to hear the result of their profound deliberations, out they come with their conclusions! which were, “that they both had arrived at the same law, proving the inaccuracy of the first supposition.”—Not that they had discovered the true situation of the Poles, but that it was inaccurate to suppose that they were on, or near to the surface of the earth; and for aught that they knew, the Poles might be dancing about in the atmosphere along with the Aurora Borealis.

The variation of the Needle was another difficult subject to account for with learned men; and after various conjectures concerning the cause, they at last agreed that it was owing to there being four Poles in the earth,—two at each end, and that the variation was owing to the Needle being attracted first by one Pole, and then by the other, alternately. Several extensive journeys were made for the very purpose of locating these Poles; and sometimes one wise man, regardless of what another had done, would establish his Pole, until sometimes they had half a dozen. Professor Hansteen, of Christiana, undertook a journey into Siberia for the purpose of ascertaining the true situation of the Magnetic Poles. It was not to be expected that the professor would undertake so long a journey without coming to any result; and accordingly he established a Magnetic Pole to the North of Siberia; thus acquiring for himself great celebrity for his profound learning, and establishing for his master a character of great liberality and devotion to the sciences. It is very remarkable, that while philosophers were establishing so many Poles, they paid no regard to reason, analogy, or consistency in accounting for them, for they still adhered to their former supposition that the earth is a Magnet. If then it was difficult to account for several circumstances and incongruities that occurred with two poles, what must it be when there were four; and when in fact all resemblance to a natural Magnet was entirely lost; for there could not possibly be four poles to one Magnet.* There are indeed frequently in a long Magnet seven-

* It would appear that in a long Magnet, the fluid is apt to pass out and re-enter again, before passing out at the end. It is probably owing to this circumstance that the Dutch people paint their Magnets in the middle, leaving the two ends bare; and that Electricians wind the wires of an Electric Telegraph with tarred thread, or some other non-conducting substances, to prevent the escape of the fluid, until it passes to the end.

ral sets of poles, or consecutive poles, but that there should be two at each end, is quite ridiculous, and at any rate it does not account for the variation of the Needle. The Magnet, it is said, in different places in the world declines a little to the west, and after a while returns to its former position, and declines to the east. Now if this were owing to two poles near the end of the earth, the one a little to the west, and the other to the east, how could the Needle return after it was attracted by one pole? It would certainly always remain towards the nearest, because the other would have less influence over it, if distance diminishes the attraction as is found to be the case in all natural magnets. But there is so much incongruity apparent in these suppositions, that we wonder how any sane person could for a moment sustain them.*

There is a theory assumed by Aumpere, that a Magnet consists of an infinite number of circular currents of Electricity; and which after a long and tedious explanation, he gives as the cause of the polarity of the Magnet. We candidly confess that we have never been able to understand the principles he assumes, nor the reason of the results that he arrives at in consequence of his assumptions, a diagram of which is given in Lewis Beck's work on Chemistry. We are aware of the remark, that ignorant people condemn what they do not understand. But we beg pardon for saying, that when a man assumes a theory that requires a great deal of learned explanation to make it appear correct, the presumption is that something is wrong about it; but people believe it, because it may have some resemblance to truth, and because they are unwilling to have it presumed that they are ignorant. Taking our leave of Philosophers, we will add a few remarks relative to our own system. This great mystery that attaches to the ends of the earth, and deranges the directive powers of the Needle, causing it to dip and to become almost vertical, is in our opinion, nothing more than a turn or shift that the current of Electricity takes there. The dip of the Nee-

* Captain Ross who has lately arrived in England from a voyage of discovery to the South Polar Seas, has, it seems, discovered that philosophers were mistaken in supposing that there existed two Magnetic Poles at the South; for at the place supposed by Professor Gaus to contain one, he could not discover any, after having arrived at the very spot designated; and he concludes that there is only one South Magnetic Pole. But he does not inform us whether he ever arrived at the spot necessary to determine by actual observation, even the existence of this; and he will probably ultimately arrive at the conclusion, that there are no Magnetic Poles in the earth at all; and that the Magnetic influence is owing, as we have stated in this pamphlet, to an universal current of Electricity. The following passage that I have extracted from the New York Sunday Bulletin of Dec. 24, 1843, tends strongly to confirm our theory of an universal Current of Electricity.

General motion of the Air.—"It has been decided from observations made with Whewel's Anemometer, that there is on the average, a general motion of the air, from South to North, two Maxima, and two Minima, have been shown in the force of wind during every twenty four hours, the force increases as the Barometer falls, and decreases as it rises.

dle, and the circumstance of its getting almost vertical at the extreme North, would seem to give some grounds for the hypothesis, that the current goes downwards into the earth to a great depth there at a particular point, and returns through the centre of the globe to the South, where it causes the Needle to rise in proportion as it is depressed to the the North. These two facts, the depression and rise of the Magnet, are strong evidences in support of the supposition, that the current descends and returns through the crust of the earth to the South, and thus continuing a perpetual current. Electricity is the rarest fluid yet known; and this has been one great cause of its real nature remaining so long undiscovered; in the manuscript that we hope soon to publish, we will clearly show that Electricity when visible, is nothing else than an accumulation of light, or light condensed and concentrated by mechanical or chemical means, such as friction, compression, or decomposition of any kind of matter.

ON THE TIDES OF THE OCEAN.

It has been the practice with some authors in every age of the world, when in proposing a theory, or in maintaining an argument—to base their systems, and to draw their conclusions from false assumptions—assumptions that have never been thoroughly investigated or admitted as correct, by the general consent of mankind. In the theory we are about to propose, we shall endeavour to avoid this error, and we shall assume nothing but what has been long considered as well established by the great body of modern writers, and what in our judgment is highly probable.

The diurnal motion of the earth, or more properly speaking, the revolution of the earth on its axis, (although only a theory) has never been called in question that I am aware of, as to its correctness, and it has been long received as the most satisfactory way of accounting for the alternation of day and night. But although we are bound to respect a theory, that has for a very long period obtained general belief, (at least until a more plausible one is proposed,) yet it does not follow, that because the principal part of a supposition is very probable, that the whole of the details must be correct; and an individual may very justly entertain doubts and surmises about some of these, and may so express himself, although he has nothing better to propose in their stead.

The revolution of the earth on its axis, is a very common mode of expression with philosophers, by which they would designate the motion of the earth; but they have left us entirely in the dark as to what kind of an axis it is—whether it is like the axle of a chariot wheel—or whether it remains stationary, and supported at each end. If the latter supposition be the one admitted by learned men, the question naturally arises, what becomes of the supports, and what material is the axle composed of? It must be of a different material from the calcareous fragile substance of the earth, as is it has to undergo a great deal of friction; and the part of the earth in contact with it must be of the same material.

These considerations, together with the sound that might be supposed to be produced by friction, and some other matters philosophers have said nothing at all about. It would appear that this part of their subject they were afraid to touch, and have accordingly passed it over entirely unnoticed, at least nothing of the kind has come under our observation. This operation appears as difficult a matter to account for as the motion of the planets; and indeed it appears to us far too unnatural and artificial, and constantly reminds us of the workshops of the mechanic and factories—instead of the simple and efficient operation of nature. We cannot perceive why it is not just as probable a supposition to suppose that the earth has no axis, and that it is all the time falling into space, revolving as it descends, and that the whole of the planetary system is descending in like manner; but that each by a nice adjustment in density and the action of its own atmosphere, preserves its relative position. I do not propose this theory as free from inconsistencies, although I think it is just as plausible as the one at present established. It would however, be as difficult to account for the regular motion of the earth one way as the other, and in fact the cause of motion is in my judgment very difficult to explain, except we refer it to the direct agency of divine power! In tracing the relation of one thing to another, we always arrive at a point with regard to motion, that is very difficult to comprehend, and are compelled to acknowledge the existence of a supernatural power, that actually (to use a mechanical phrase,) “puts his shoulder to the wheel.” The cause of Motion then, we consider as a very striking and forcible proof of the existence of a Deity, and leaves the arguments of atheists perfectly untenable.

But we do not intend in this place to enter into a discussion concerning the cause of Motion. That the earth is a spherical body, and performs one revolution every twenty four hours, is all that is necessary for our purpose on this subject, and this we presume no one will dispute. There is only one subject more to which we would call the attention of our readers before proceeding with the details of our theory, and that is the density of the atmosphere. It is now we believe, a doctrine very gene-

rally acquiesced in, that it is the pressure of the air on the surface of the earth, that prevents every thing from being detached. And were it not for this action, all substances not adhering, would fall or bound off, such as stones and animals, streams of water, and even the ocean itself. It is the force of the circum-ambient air, that is known to be equal in weight to a column of water thirty three feet high, that confines all objects to the surface of this globe, and hence, in obedience to this law, water is compelled to find its own level, and instead of rising upwards, or falling downwards as the case may be, it moves along the surface from the impetus it receives.

Having made these remarks, we will proceed to detail a theory, accounting for the tides and currents of the ocean, and that on a different principle from the one which now obtains. The spherical figure of the earth, its diurnal revolution, the compression of the atmosphere, are the subjects on which we found our theory; and these we consider highly probable, and have obtained the general consent of mankind for a long period of time. The last mentioned subject, the weight of the air we consider as completely demonstrated.

Before proceeding with our details, we will make a few remarks designed to shew the improbability of the present theory of the tides, and these will be confined to one particular, the supposed influence of the Moon. The coincidence between the Moon and the Tides, was observed we believe long before Sir Isaac Newton's time but it was he who first pointed out the mode in which that planet was supposed to act on the great body of the ocean. After the best consideration that we are capable of giving the subject, we do not perceive any relation established between the Moon and the Tides, and that the whole subject has been inferred from mere coincidence only. This mode of reasoning is to our minds far from being satisfactory, without its being taken in conjunction with some analogous circumstances—which are entirely wanting in the present case. It is inferred that because the Tides are higher at the full, than the wane of the Moon, and other coincidences, that she must exert an influence on them; and then the manner in which this is done is particularly described. This mode of reasoning has been a fruitful source of error in every age of the world, and the foundation of a great amount of superstition.

If we were to reason from mere coincidence alone, a great many other operations of nature, besides the flux and re-flux of the waters of the ocean, might be attributed to the influence of the Moon, with as much probability as the said theory. Animals are sometimes much agitated during full Moon. Chancellor Bacon, (it is recorded,) was subject to Syncope during the full Moon. Hoffman reports a young girl that labored under a painful swelling of the leg, beginning and ending with the increase and decrease of the Moon. These occurrences, together

with others that are unnecessary to mention, might with as much propriety be ascribed to the influence of the Moon as the Tides. Yet there are but few learned men who believe in such influences, and still fewer who can trace or point out any connection; and the bare isolated fact of the coincidence only, is all that remains to propound a theory upon. It is not denied but that the Moon may exert some power on this earth; her light may accelerate the ripening of grain, and promote the growth of plants, as some agriculturists uniformly affirm, but that she could exercise such a powerful attraction, as to lift the waters of the great deep to such an extent as is imagined in the case of the Tides,—is in our judgment extremely improbable, without its being felt equally on the earth as well as the ocean. All substances not permanently fixed to the surface would be immediately detached, and attracted towards that planet, and this would be effected much easier than with water, for in the latter case the additional circumstance of resistance, a natural tendency to find its own level would have to be overcome. This part of the theory we consider as the most improbable of the whole system.

The following is our hypothesis, which we offer as being more rational, and liable to fewer exceptions than any other. Philosophers have asserted that there are seven tenths of the whole earth covered with water, and the remaining three tenths only are dry land. Although this statement may be perfectly correct, in the sense in which they understand it, yet there cannot be a doubt but that there is more land than water; for the ocean itself, and all large bodies of water whatever, have land for their base, or rest upon land. I think it very probable however, that there are exceptions to this remark, and these exceptions I consider as the real cause of the rising and subsiding of the waters of the ocean: in other words, I presume that there are two vast openings at the bottom of the sea through the whole diameter of the earth, (crossing each other at right angles, and acting independent, or meeting in the centre as the case may be,) by which the waters are connected, and that during the revolution of this globe, which is performed once in twenty four hours; each end of the opening will be uppermost alternately every six hours, and the waters of the uppermost end will press or sink towards the lower, causing a flow at the higher, and a full tide also at the lower; and of course there would be a flux and re-flux at the same place every twelve hours. If this supposition were correct, we should of course have double the number of tides as days during the year; but a great many circumstances interfere to prevent this regularity, and it would only be in some situations where a perfect uniformity could take place. The parts of the earth at a distance from the opening, would have the tides less frequent during a year than those situated near it, and the inequalities at the bottom of the ocean, would cause considerable irregularity in the motion of the tides. Mariners assert, that it is very difficult

amongst islands to ascertain which way the tides flow; and this is doubtless caused by the uneven bottom obstructing the passage of the current. Where the bed of the ocean is smooth or nearly so, the tides would be more uniform and regular. This may account in some measure, for the irregularity of the tides in different parts of the world. But there is another circumstance to be considered which would also tend to this result. In all likelihood, there are a number of these openings in different parts of the ocean remote from each other, in a different parallel of latitude, and of course, there would be a difference in the time of the rise and depression of their waters, owing to the motion of the earth, and where their tides meet, there would be a confused agitation of the sea. We have been informed by seafaring men, that there are different places in the ocean, where the waters have a rough boisterous appearance without any storm or wind—may it not be owing to this circumstance, as much as to the action of the wind impelling a greater body of water in that direction.

In order to convey as clear and distinct an idea as possible of these great hydraulic communications, we will endeavour to illustrate the operation in a very simple manner, so that it may be understood by persons of almost any capacity.

If two funnels were soldered together at the small ends, then held in a perpendicular position, and filled at the upper end with water, it would immediately pass through, without spreading out at the funnel or flange below; because in this instance, the weight of the atmosphere presses everything towards the surface of the earth; and the gravity of the water itself, without the air, would effect this; but supposing that the soldered funnels were an isolated object, and were placed in the actual position of the earth itself, and encompassed like it by the pressure of the air equally on all sides,—it is evident then, that the gravity of the water of the upper funnel, independently of any other circumstance, would force the water to spread out towards the flange or edge of the lower funnel, instead of dropping from it; for in this instance, the atmosphere would prevent it; and this object as it gradually revolved round, would cause a flow and an ebb at the same place alternately, during one revolution. If we now take a second pair of funnels and proceed with them in the same manner, placing them at right angles to the former, we shall have a complete example of the mode of operation that is intended to be conveyed. This we imagine, is the mode of operation of these great water communications at the bottom of the sea, and we can perceive nothing in it at variance with the strictest principles of sound philosophy.

It would be very foolish in us to attempt to state the dimensions of these openings; but if there is only one location of them, it must be very large, if there are a number of them, the dimensions will of course be less; still they must all be large according to our conceptions of objects; since their length through the whole diameter of the earth is very great, being generally

stated at seven thousand miles. Were I to hazard a conjecture about their locality, I should say that there may be one, and that probably the largest at the equator. We have been informed by a gentleman acquainted with nautical affairs, that the tides commence first at the equator, and proceed in every direction, as if from a common centre. I do not consider this gentleman very good authority, but I am not aware of any circumstance that militates against this observation.

It has been long a common remark with mankind, that the sea had no bottom; this idea doubtless originated in consequence of their unavailing efforts to fathom it, but it will be a singular circumstance, if this observation should prove correct.

If we examine an American Almanac of 1841, containing calculations for the United States, and beginning with the month of January, we shall find the high water quoted for Boston, at 4 hours 14 minutes, and for New-York at 1 hour 14 minutes; here is a difference of 3 hours, and so on with other places; and in looking over the whole month, we find the returning full tide $1\frac{1}{2}$ hours later each time, and sometimes only half an hour, or varying from half an hour, to one hour and fifty minutes. We have ascribed this difference to the distance the waters have to travel,—the inequalities at the bottom of the sea, and peculiar position of places. But there is still another circumstance to be accounted for, that is, the frequent occurrence of very high tides, and very low, or neap tides.

In the present received theory, the Moon is held insufficient to account for that circumstance, and the aid of the Sun was called in. It is well known that the wind is a powerful agent in forcing the waters of the ocean in the direction in which it blows, and very high tides are sometimes the consequence of this; a storm of wind will also retard the flow of the tide when opposed to each other. Examples of both these statements are of very frequent occurrence, and sometimes they produce disastrous results. It would seem to be the intention of nature, and no doubt a very provident law in her economy—that there should be a body of water continually in motion, adapted for different operations in that great element,—and where there is a surplus at one place, there is a deficiency at another, and in fact, this must of necessity be the case, according to the strictest logical principles; for if there is a certain quantity of water on this earth, the removal of any portion from one place to another, must cause a flow at the one and an ebb at the other. It cannot be supposed that the Deity creates water at one place, and annihilates it at another. It is a much more reasonable conclusion, deducible too from well established principles, that there is not one drop more or less of water in the world since the creation; and the removal and replacing of it, causes that pleasing variety that is so striking a trait in the works of nature. But it may be objected here, that these very high and very low tides, have an uniform character, occur every month, and of course must have a regular cause. We have already stated, that strong

winds blowing for a length of time in one direction, might be one cause in producing the above effect. In confirmation of this, we will here state a simple case or two. It is evident that were a powerful wind blowing in the direction of North, a superabundance of the waters of the ocean would be driven in that direction; and if this should happen to be at a distance from any opening, of course there would less descend through, the wind preventing in a great degree its return to the great gulph, as it may be called, until one end had passed in revolving. If the wind continued long enough, the next high tide would also be very high at the same place, causing a succession of high tides, while at another situation, there would be a succession of low tides.

In describing the revolution of the two openings, we have remarked that there would be a flux and re-flux at the same place every 12 hours, or in other words, that there would be an ebb in 6 hours, and a flow in 6 hours more—alternately. This requires some explanation which we will proceed to give, as it is our intention to consider it fully in all its bearings. These two openings we have stated to pass through the whole diameter of the earth, crossing each other at right angles, and acting independent of each other; or they may be supposed to meet in the centre, which circumstance would make no difference as to the operation, as the waters would pass through the one only, that was perpendicular, in preference to taking any of the two passages at the sides. These two passages would constitute four openings, or one at each side, supposing the circumference of the globe were divided into four parts, or if divided by time, it would leave 6 hours for each to change its location. There must then be an ebb and a flow alternately, which we suppose to be effected in this manner. While one opening is uppermost, there must of course be one directly under, the waters of the ocean will flow into the upper, and pass through to the lower, causing a flow at both places, or a full tide at the same time both with us and our antipodes. The openings at each side would have an ebb at the same time, causing a re-flux at the same instant both with us and our antipodes. Some people may not conceive how the waters could flow from the sides to the upper cavity, as in that case they would have to rise from their level. To this objection it may be remarked, that the sea would flow towards the place where it had found an opening, and a current would be created, tending to that situation; and besides, the spherical figure of the earth is so little at short distances, that it has never been considered as opposing any obstacle to the passage of the waters either way. And indeed if we allow for the sake of argument that it does offer resistance, we must also admit that there would be great facilities for its descent, and the whole of the waters of the ocean where they encompassed the globe, would subside towards the lowest part with a vengeance, at every revolution of the earth. In the present received theory, and in that part of it that relates to the influence of the tides,—it is affirmed that that planet raises the

waters of the ocean at the same instant of time with us, as it does with our antipodes; and the arguments that they adduce to enforce this supposition, are in our judgment much more applicable to our theory than to the one just stated.

At a first consideration, it would seem that these great hydraulic communications could exist only where the ocean encompasses the globe from east to west, or any other direction; but this is not necessary in the fullest sense of the term, for large spaces of dry land might intervene between the cavities, provided there were a small opening for the egress and ingress of the waters, and a narrow space of two or three hundred miles could afford passage for a vast body of waters. All the great seas are found to be connected with each other.

We consider that these explanations will afford a sufficiently clear idea of our theory to a common reader, without exhibiting a drawing; for he has only to conceive the upper cavity, (which he may call No. 1 if he chooses,) being filled to overflowing, in consequence of the rush of waters from both sides, and in the places of the earth adjacent to these sides or openings, there would be an ebb of the waters; while at the places of the earth contiguous to No. 1, there would be a flow; as the earth revolved round in 6 hours, No. 1 would be at the side where it would have an ebb. In the third place, in 6 hours more, it would be right under where it would have a flow in consequence of the descent of the waters; in another 6 hours, it would be at the opposite side, where it would ebb; and in the last 6 hours, it would again arrive at the upper situation, having completed the circumference of the globe.

It does not seem to have occurred to philosophers, that there might exist vast chasms extending through the whole diameter of the earth. The circumstance however, in our judgment, is very probable; and independently of its being a very plausible method of accounting for the cause of the motions of the waters, it is the most simple and rational theory that we have as yet seen proposed. There are no other operations in nature that we are acquainted with, that has any resemblance to this, from which we might trace some analogy; but there are some collateral circumstances that may be considered as having a tendency that way. We have read of the existence of vast chasms in the earth, on dry land—and there is one mentioned by Goldsmith in his Natural History, of which he says, “the inhabitants of the place where it is situated, have been in the habit of paying it a kind of adoration; they believed it had no bottom; and for a great length of time, they had been in the practice (at stated intervals,) of turning into the chasm, large droves of cattle and sheep by way of propitiatory sacrifice.”

We are also informed by the same author, and by other natural historians, “that there are fresh water lakes in different places of the world, that are subject to a flux and re-flux.” May not this so happen in consequence of these waters communicating through the whole diameter of the earth, to another

body of water, immediately under, or opposite; and as the earth revolved, the uppermost would press towards the lower, causing an ebb at the one, and a flow at the other; for in this instance, there would be no water to flow from the sides, owing to the small area of the lake; and of course, there would only be a flow and an ebb every 24 hours; whether such is the fact or not, I have not been able to learn.

A writer in the *New-York Mail*, gives the following account of a remarkable pond in Sussex Co. State of New-York.

“White Lake is situated about one mile west of the Paleres Rill, in the town of Stillwater. It is nearly circular, and about one third of a mile in diameter; it has no visible inlet, but its outlet is a never failing stream of considerable magnitude. From the centre, or dark portion of the lake at stated seasons, innumerable quantities of shells are thrown up, of various sizes and forms, but all perfectly white, these float to the shore, and are thrown out upon the beach, or sink into shallow water; the soil around the lake is formed of them. In the centre of the lake, bottom has never been found; although it has been sounded to the depth of several hundred feet.”

The inference that may be deduced from the above extract, is this. That this pond may have a communication through the whole diameter of the earth, to another body of water containing large quantities of these shells; and the circumstance of their being thrown up in the pond, in greater quantities at one time than another, might be owing to the body of water opposite, being carried by the action of the wind, in that direction more so at one time than another, and of course would carry into the openings a larger quantity of shells. The following is extracted from a *New-York Newspaper*. *Tide Wells*.—“Several wells in Morris Co. New Jersey, regularly ebb and flow about six feet twice in twenty four hours, one of which is on the farm of Stephen Dickerson, near Whippany, the highest land in the vicinity. The water is said to be cool and refreshing.”

I have seen a statement going the rounds of the newspapers, purporting to be related by a sea captain of truth and veracity, that “he had known a vessel lost and sunk in one sea, and was found floating in another.” Any of these statements taken separately, may not be considered very conclusive evidence in favor of our theory; but taken altogether they afford good ground for believing that the waters communicate through the whole diameter of the earth.

There is one circumstance to which we will advert before taking our leave of the tides. It may not appear clear to some readers, notwithstanding what we have already remarked, in what manner the waters of the ocean can rise from each side of the earth, and cause a flow at the top. To this we would remark, that the waters near the cavity would be absorbed first, but the rush from the sides to supply their place would cause an overflow; and it must be remembered that the earth is a spherical body, and whatever way the waters came, they would

have to come from the sides; that is if they had to come from a great distance; and of course there would be an ebb at the place from which the waters receded. This idea involves no greater inconsistency than the current of rivers, which flow up or down as the case may be, owing to the revolutions of the earth; for all streams of water flowing west or east, must be in that situation once in 24 hours. A river having its course directed to the west, the part of the earth where it is situated, must be descending at one time, and rising at another. I confess that this doctrine may appear very singular to some people, who have not bestowed much attention on these subjects, and it may seem so to some people who have, as they are apt to conclude, that because water will fall off from a ball, or circle of any kind, instead of running round with it,—that it ought to do so with the earth; I explained this circumstance before, but I may remark again here, that the circle or ball alluded to, in order to be subject to the same laws as the earth, would require to be placed in some sphere by itself; endowed with a rotary motion, and having an atmosphere of its own pressing against, and surrounding it on every side.

We will here conclude our description of the tides, by recapitulating the principles that we think we have discovered. 1st. That there are two vast openings penetrating through the whole diameter of the earth, and crossing each other at right angles; and these openings, including their commencement and termination, make four cavities, situated at regular intervals in the circumference of the globe, at the bottom of the sea; and are the cause of the tides of the ocean. 2d.—The circumstance of each returning tide being later than its predecessor, we have ascribed to the distance the tide has to travel from its opening.* 3rd. The difference in time of the tides visiting different situations that might be supposed equal in distance, is owing to inequalities at the bottom of the sea, and the peculiar disposition of places not being favorable to the advance of the waters. Lastly;

*I will here elucidate this statement by a little farther explanation. We shall suppose the nearest spot on the earth's surface, to the centre, or opening, where the waters of the ocean first receive their impetus, to be 500 miles. The second place, 1000 miles; the third, 2000, and the fourth, 3000. It is evident that the flow of the waters will reach the nearest spot first; it will be longer in reaching the second, still longer in reaching the third, and longest of all in reaching the fourth. The first spot would begin to ebb first; and indeed it might begin to ebb, while the fourth place had only begun to flow. The next revolution of the opening or returning full tide would approach the nearest spot in 12 hours, or nearly so, making at this place two full tides in 24 hours, or double the tides that there are days in the year. At the second spot, the next tide might be $\frac{1}{4}$ of an hour later than its first, or predecessor, owing to the distance. At the third, it might be $\frac{1}{2}$ an hour later; and at the fourth, there would be but very little ebb or flow, for the returning full tide would meet the waters when they had just begun to ebb. According to this calculation, there are some quarters of the world where the number of tides are about equal to the days and nights; at other parts, each returning tide is about $\frac{1}{4}$ of an hour later than its predecessor. At others again, it would be $\frac{1}{2}$ an hour later. And again, there are other parts of the globe where the ebb and flow is barely perceptible. We believe we can produce statements in proof of all these assertions, excepting the first, regarding the tides being equal to the number of days and nights in the year; our limited means of information has not yet enabled us to ascertain whether such is the fact or not. At Great Britain and its vicinity, each returning tide is about $\frac{1}{2}$ an hour later. According to observations at Winter Island, in the year 1821, '22, recorded in Capt. Parry's Voyage, the average time of each returning tide was about 20 minutes later; and at the Mediterranean, the ebb and flow is but barely perceptible. If then there is a difference of time of the tides, at different places of the world, and if at some places there is scarcely any tide at all, it is but fair to infer, that at some parts of the earth, the tides will return at regular intervals of 12 hours only, while at no place can there possibly be a full tide at, less than 12 hours. In the supposition above, I have stated the distances from the centre, to different parts of the earth at 500, 1000, 2000, and 3000 miles; but in this supposition I do not pretend to be correct as to distances; it is only an assumption, for the purpose of elucidating our ideas.

The spring and neap tides are owing to the action of the wind retarding or accelerating the advance of the waters, either at places very remote or very near.

I may remark here, with regard to the currents of the ocean, that the most plausible idea is, that these currents are rivers, flowing at the bottom of the sea; and have formed to themselves channels, and that they preserve their course in these channels, and keep the great body of water at each side at abeyance—just as a river flowing through a lake will form a current in the middle, while the waters at each side will be perfectly still. It may be thought singular why the large body of waters does not rush into the current, and mix with it. But the fact is, the current has received its impetus, and always maintains its position; and the still waters on each side can no more prevent it, than a gentle breeze of wind can prevent a hurricane; the same result undoubtedly obtains at the bottom of the sea. These currents, or rivers, occupy their channels, and are urged on in their course by the impetus they have received; the great body of sea water presenting but little obstacle. We may here introduce a fact to support this conclusion. It is asserted by mariners, that the course of some rivers may be perceived in the sea for some hundreds of miles. We will set this subject in a clear light, by asking and answering a question. What would be the result with regard to rivers, supposing the whole earth were overflowed with water—is it not very probable that all the greater would maintain their course, and flow as they at present do, they have formed to themselves channels, and would still direct their course in them, notwithstanding the great body of waters with which they might be surrounded? It is true the waters would mix in some degree, but the current would still be preserved. There cannot be a doubt but that the bottom of the present ocean was once dry land, and that the same aspect and general appearance with regard to rivers and inequalities exist there as on our earth—we think there can be no doubt of this, and therefore conclude that we have good grounds for believing that the currents existing in the sea are nothing but rivers. If we take for an example the river St. Lawrence, that forms the boundary line in some places between Canada and the United States—we shall perceive but very little current in the waters at the outlet of Lake Ontario, on commencement of the river; but it is sensibly known to sailors who make the passage much quicker down than up. Now supposing the river were augmented to six times its present quantity of water, so as to have superadded a depth of 100 fathoms, and encompassed by still water to a great depth; is it not very probable that with all these additions to its bulk, it would still maintain its current with considerable force? We have not the least doubt, but that this would be the case, but where the stream is very rapid it would be more apparent. No superincumbent mass of waters could render quiescent, the extreme agitated state of the river at what is called the rapids.

