Electrical Motion and Magnetism.

MESSRS. EDITORS—The causes of electrical motion are said to be various, but electricians have classified and reduced them to a few heads, as friction, change of temperature, chemical action, and change of form. My object now is to suggest a still further simplification of these causes. And with this object in view let it be asked can we not detect a single principle underlaying all these causes, to which alone may be referred the phenomena of electrical motion?

Friction: In what does this consist but in the forced motion of one body along the surface of another with which it is in apparent contact?

Now no surface can be made absolutely smooth, and the nearer it comes to being smooth the less friction can be effected with it. The surfaces, then, between which friction is produced, are bestudded with projections or molecules. When these surfaces are brought together their molecules will mutually settle in between each other, and while in this position one surface is to be forced along the other. But the force thus exerted is evidently expended in pressing the molecules of one surface against those of the other which resist its free motion. This must obviously compress the resisting molecules, and hence, in friction we have condensation among particles. In illustration, rub one rasp upon another, and the teeth of the two will assume a precisely similar relation to each other, as do the molecules of the two surfaces employed in friction.

Change of temperature: This consists in the diffusion of heat through a body, or its abstraction from it. But one principal effect of heat is its repulsion. Therefore the increase of heat separates particles from each other, and its diminution allows their cohesion to bring them nearer together. Hence condensation (or expansion) among particles is the result of change of temperature.

Chemical action: What is this but the formation or the breaking up of compounds? To form a compound we have simply to bring together particles of matter under such circumstances that their attraction for each other shall be greater than their attraction was for the particles by which they were before surrounded. But their attraction being greater, they must come nearer together or be condensed. In breaking up a compound we must pursue an opposite course, and expansion among particles results.

Change of form: In solidification or liquefaction the presence of condensation or expansion among particles is too obvious to need comment. But mark here, that condensation may take place among the particles of a body, while the body itself may be spread over a larger space than before, and *vice versa*. Thus steam escaping from great pressure is at first transparent, but, on being condensed by the cold air, it is opake, notwithstanding it occupies a larger space than before escaping; the explanation of which I apprehend to be, that the particles of steam are condensed into minute drops of water separated from each other, and their interstices occupied by air. I would suggest, then, that electricity exists in *situ* only between the particles of which substances are composed, that when, by condensation, the particles are brought nearer together, the electricity is forced to the surface and is called positive, and there remains until, by expansion, the body regains its original capacity, or until a conducting medium takes it away to form an equilibrium among other substances. On the other hand, if a body is subjected to expansion among its particles, its capacity is increased, and it is negative until a conducting medium supplies it with electricity from surrounding surfaces.

If by any means we crowd more than an equivalent of electricity into a body, we render the body magnetic; thus soft iron becomes a temporary magnet; but if we surround each particle in the soft iron bar with an atmosphere of carbon (a non-conducting medium) as it exists in steel, the bar becomes an electrical battery, each particle of which—with its atmosphere of carbon—is a Leyden jar. By charging the bar, but not too strongly, with electricity, it will retain its charge and become a permanent magnet.

In applying this theory to account for lightning, we should say, water at the earth's surface has its own equivalent of electricity—it is changed to vapor. This expansion increases its capacity for electricity which it receives from surrounding objects, and thus laden, it floats in the air, a cloud, rises to a colder stratum of air, is condensed back to water, and thus, losing its increase of capacity, electricity is evolved. When this condensation takes place gradually, as in a mild storm, the air between the cloud and the earth becoming moist, and consequently a better conductor, the electricity passes back to the earth as fast as it is evolved, and we witness none of its phenomena. When the vapor is frozen with little or no condensation, as in a snow-storm, little or no electrical excitement is exhibited. When, as in a hail shower, the vapor is condensed to drops, and then expanded a little by freezing, the electrical excitement is probably less intense than it would otherwise have been. But when the vapor is condensed so suddenly that the air remains dry until enough electricity shall have been evolved to acquire the requisite intensity, it then leaps through the air to a less electrified body, forms an equilibrium, and is again at rest.

W. A. G.

Cheap Electrical Machine.

MESSRS. EDITORS—In making some experiments with electricity, and not being able to procure the necessary apparatus—such as are generally used—I found that by a combination of the principles of the Leyden jar and electrophorus I could construct an electric machine cheaper, simpler, more compact, &c. Take a piece of india rubber or gutta percha, say sixteen inches square, cover it on both sides with tin foil, in the manner of constructing a Leyden jar; this I call a Leyden plate; place it on a table or other suitable place, and put another piece of india rubber on the top of the first, rather larger than the surface of the tin foil. Next place a circular piece of tin or other metal with an insulating handle on the uppermost piece of india rubber, and connect a slip of tin foil with the surface of the tin foil on the upper side of the leyden plate, and double it over so that when the circular piece of tin is placed on its place it will come in contact with it. By exciting the upper piece of india rubber with a piece of fur, and then putting the tin plate on it, a spark will pass from the upper surface of the leyden plate through the slip of tin foil to the tin plate, which, on being raised by its insulating handle, will give a spark like a common electrophorus. This being repeated several times, the electricity is literally pumped out of the upper surface of the leyden plate. On making connection with the hands or otherwise with the tin plate and the under surface of the leyden plate, a shock will be received in power according to the size of the machine. This is a brief description of the method of constructing a new electric machine, &c.

Machines constructed on this plan, and of materials like those mentioned, combining simplicity, compactness, and durability, would be suitable instruments to introduce into common schools.

WILLIS KNICKERBOCKER.

Webster City, Iowa, Nov. 2d, 1856.

Improvements in Stereotyping.

A paragraph of a very unintelligible character was recently published in several papers, purporting to be a description of an improved process of stereotyping invented by Messrs. Hogg & Napier, of Edinburgh. As any improvement relating to the art of printing is of great importance, and as an untrustworthy account of it does more harm than good we present the following account of this invention from the *London Mechanics' Magazine*, which, it says, "is perfectly reliable."

"The first part of it relates to the formation of the matrices, and is as follows:—Firstly, a thick viscid plate is to be prepared by the intimate admixture, in about equal quantities, of red ochre and fine whiting, together with a sufficient quantity of prepared thin glue, starch, and wheaten flour (also in about equal proportions) made up into a paste, a little alum being included in the latter compound. Of the glue and paste there is to be employed just as much as is necessary, when all the components have been properly mixed to make the compound a stiff paste. A quantity of this is then to be spread upon the surface of a piece of stout packing paper, cloth, or other suitable fabric, and a straight edge of any convenient kind passed over it, so that the coating of paste may be rendered uniform in thickness. The amount of paste spread on should be about equal to the thickness of a three-penny piece, as at present issued from the mint. This combination of paste and packing paper (or other substance) is now allowed to stand under the influence of the atmosphere for about half an hour, until the surface becomes nearly dry. The "page" or "form" of which a cast is required to be taken is next laid down with the face uppermost, a slight coating of lard or other oil being brushed over it, and the flat matrix laid down upon the face of the types or "form," that surface upon which the paste or composition had been spread being next the oiled face of the "form." In this condition the whole is to be subjected, in a printing press or other convenient apparatus, to slight pressure, sufficient to press firmly and evenly the matrix into the face of the types upon which it has been laid. A single and very light "soaking" pull at a printing press is sufficient for the purpose, or the impression may be taken by the implements known to printers as a "planer and mallet," used in the same way as when "planing over" a form of types. After the impression is obtained, the matrix must not be moved from contact with the "form" until it has been partially dried, and while this is going on, it is necessary to place a weight of some sort upon the back of the matrix. The best way is to place the bottom of the "form" or "page" upon a plate of heated metal, keeping at the same time some flat heavy weight upon the back of the matrix. In a short time (varying according to the amount of heat employed) the matrix will have partially dried, whilst lying upon the face of the "form," and when withdrawn therefrom will be found to afford an exact reverse copy and mold of the "form" or "page," operated upon."

Color Phenomena of Certain Solutions.

Sir John Herschel first brought publicly into notice the fact that certain solutions appear of a different color according to the quantity seen through. The water of the ocean, for example, when lifted in a common tumbler, is clear and transparent—colorless; but looking down into a great body of it, as in the Gulf stream, it appears of a deep indigo color.—There are also certain varnishes, one coat of which is of a light brown color, but successive coats laid on the top of one another assume a black appearance. Dr. Gladstone read a paper on this subject before the late meeting of the British Scientific Association, of which the following is an abstract:—

"A dichromatic solution was examined by placing it in a wedge-shaped glass trough, held in such a position that a slit in the window shutter was seen traversing the varying thickness of the liquid. The diversely colored line of light thus produced was analyzed by a prism; and the resulting spectrum was represented in a diagram by means of colored chalks on black paper, the true position of the apparent colors being determined by the fixed lines of the spectrum. In this way the citrate and comenamate of iron, sulphate of indigo, litmus in various conditions, cochineal and chromium, and cobalt salts were examined and represented. Among the more notable results were the following:—A base, such as chromic oxyd, produces very nearly the same spectral image with whatever acid it may be combined, although the salts may appear very different in color to the unaided eye. Citrate of iron appears green, brown, or red, according to the quantity seen through. It transmits the red ray most easily, then the orange, then the green, which covers the space usually occupied by the yellow; it cut off entirely the more refrangible half of the spectrum. Neutral litmus appears blue or red, according to the strength or depth of the solution. Alkalies cause a great development of the blue ray; acids cause a like increase of the orange, while the minimum of luminosity is altered to a position much nearer the blue. Boracic acid causes a development of the violet. Alkaline litmus was exhibited so strong that it appeared red, and slightly acid litmus so dilute that it looked bluish purple; indeed, on account of the easy transmissibility of the orange ray through an acid solution, the apparent paradox was maintained that a large amount of alkaline litmus is of a purer red than acid litmus itself."

Screw Propeller Experiments.

Screw steamers have become great favorites during the past few years, on account of their greater economy than paddle wheel steamers. Any information relating to them is, therefore, of deep interest to our marine engineers and steamship owners. The following account of exceedingly valuable and interesting experiments is from the London *Artizan*:—

"The experiments which have been going on for some time on H. M. S. *Flying Fish*, Commander Dew, which is about 900 tuns measurement, and 350 nominal horse-power, and constructed on beautiful lines, have now terminated. When first tried (May 13th,) she had on a common screw of 11 ft. diameter, and 21 ft. 4 inch. pitch, which gave her a speed of 11 1-2 knots, with 82 revolutions of engines. This result not being considered satisfactory, such alterations were made as to get in a 12 ft. 2 inch. screw, with 20 ft. pitch, which gave her a speed of fully 11 1-2 knots with 75 revolutions, and when reduced to half power (60 revolutions) 10 knots. The Lords of the Admiralty having ordered a Griffiths' screw for her and the gun-boat *Bullfinch*, Mr. Griffiths requested to be allowed to supply these screws with an extra set of blades, constructed so as to incline at an angle of 18 degrees towards the ship, which could be shipped into the center part of his screw, for trial instead of the ordinary blades. This was acceded to, and these blades were first tried on July 14th, with a pitch of 19 ft., the diameter, same as the common screw, 13·2, which gave a speed of 11 1-4 full, with only 71 revolutions. It was then perceived that by inclining the blades of the screw it had considerably more hold on the water, and consequently reduced the slip. The pitch was afterwards reduced to 15 ft. (July 30) when a speed of nearly 12 knots was obtained, and with half power (60 revolutions) about 10 knots, the screw making a negative slip of about 3-4 of a knot.

It was then ordered by the Lords of the Admirality that a temporary bow should be put on her of about 30 ft. long; and a trial was made September 12th, first with the common screw of 13·2 diameter, 20 ft. pitch, and a speed of full 12 1-2 knots was obtained; and with half power (40 revolutions) 10 knots—the temporary bow giving the ship a knot more speed at full power, but no increase of speed at half power—on September 30th. She was then tried with Griffith's screw of 13·2 diameter, and 19 ft. pitch, when a speed of nearly 13 knots was obtained. In consequence of an experiment that was tried on the *Bullfinch*, by reducing Griffiths' enclosed blades from 6 ft. to 5 ft. 4 inch. diameter, and setting it at the same pitch as the common screw of 6 ft. diameter, which gave the vessel nearly half a knot more speed with the same amount of power, it was decided to try the same experiment on the *Flying Fish*. Her screw, with the enclosed blades, was reduced from 13·2 to 12 ft. and 20 ft. pitch (October 18th) which gave her a speed of 12 knots, the engine only making 70 revolutions. The pitch was then reduced to 17 ft. (in October 22), the engines then made only 75 revolutions, the ship 12 1-4 knots barely."

Louisville Mechanics' Institute Fair.

The Mechanics' Institute Fair at Louisville, Ky., has just closed. The *Democrat* of that city says it had a most successful career.

The attendance was very large, and, in an eminent degree, complimentary to the officers of the Institute and the contributors.

The closing Address, by R. T. Durrett, Esq., was chaste, practical, and elegant. Its appropriateness to the occasion was remarkable and the speaker's subjects were discussed with ability.