To show the radiating powers of the different surfaces, the sheath is turned so that the open side is exposed to the air; the absorption of heat now becomes sensibly constant, and the greater or less height of the liquid in the tube, is determined by the less or greater radiating power of the exposed surface.

The order in which the surfaces are exposed may, of course, be so arranged as not to require the temperature of the source of heat to be kept constant.

Such an apparatus, placed before a stove, would make an admirable illustration in a school, or a vessel of water, colder or warmer than the room, may be used as the radiating or absorbing body. For the tin vessel here described, a common square glass bottle may be substituted, without disadvantage. Even a common glass phial, made into an air thermometer by inserting a tube through a tight cork, into some liquid occupying the lower part of the phial, and provided with a movable coating of tin foil, gilt paper, writing paper, and paper covered with lamp black, when placed before a fire, or in a room of which the air is warm, when the external air is cold, brought near a window, will afford an interesting and instructive illustration.

Philadelphia, February, 1835.

ART. XXIV.—*Facts in reference to the Spark, &c. from a long conductor uniting the poles of a Galvanic Battery;* by JOSEPH HENRY, Professor of Natural Philosophy in the College of New Jersey, Princeton.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—The American Philosophical Society, at their last stated meeting, authorized the publication of the following abstract of a verbal communication made to the Society, by Professor Henry, on the sixteenth of January last. A memoir on this subject has been since submitted to the Society, containing an extension of the subject, the primary fact in relation to which was observed by Professor Henry as early as 1832, and announced by him in the American Journal of Science.* Mr. Faraday having recently entered upon a similar train of observations, the immediate publication of the

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* Vol. XXII, p. 408.

accompanying is important, that the prior claims of our fellow countryman may not be overlooked.

Very respectfully yours,

A. D. BACHE.

One of the Secretaries Am. Philos. Soc.

Philadelphia, Feb. 7th, 1835.

Extract from the proceedings of the stated meeting of the American Philosophical Society, January 16, 1835.

The following facts in reference to the spark, shock, &c., from a galvanic battery, of a single pair when the poles are united by a long conductor, communicated by Professor Joseph Henry, and those relating to the spark were illustrated experimentally.

1. A long wire gives a more intense spark than a short one. There is, however, with a given surface of zinc a length beyond which the effect is not increased; a wire of one hundred and twenty feet gave about the same intensity of spark as one of two hundred and forty feet.

2. A thick wire gives a larger spark than a smaller one of the same length.

3. A wire coiled into a helix, gives a more vivid spark than the same wire when uncoiled.

4. A ribbon of copper, coiled into a flat spiral, gives a more intense spark than any other arrangement yet tried.

5. The effect is increased, by using a longer and wider ribbon, to an extent not yet determined. The greatest effect has been produced by a coil ninety six feet long, and weighing 15 lbs.; a larger conductor has not been received.

6. A ribbon of copper, first doubled into two strands, and then coiled into a flat spiral, gives no spark, or a very feeble one.

7. Large copper handles, soldered to the ends of the coil of ninety six feet, and these grasped by both, one by each hand, a shock is felt at the elbows, when the contact is broken in a battery of a single pair with one and a half feet of zinc surface.

8. A shock is also felt when the copper of the battery is grasped with one hand, and one of the handles with the other; the intensity, however, is not as great as in the last case. This method of receiving the shock may be called the direct method, the other the lateral one.

9. The decomposition of a liquid is effected by the use of the coil with a battery of a single pair, by interrupting the current, and introducing a pair of decomposing wires.

10. A mixture of oxygen and hydrogen is also exploded by means of the coil, and breaking the contact, in a bladder containing the mixture.

11. The property of producing an intense spark is induced, on a short wire, by introducing, at any point of a compound galvanic current, a large flat spiral, and joining the poles by the short wire.

12. A spark is produced when the plates of a single battery are separated by a foot or more of diluted acid.

13. Little or no increase in the effect is produced by inserting a piece of soft iron into the centre of a flat spiral.

14. The effect produced by an electro-magnetic magnet, in giving the shock, is due principally to the coiling of the long wire which surrounds the soft iron.

Appendix to the above—on the Action of a Spiral Conductor, &c.; by Prof. Joseph Henry, Princeton College.

TO PROF. SILLIMAN.

With this I send you a copy of a paper communicated by me to the American Philosophical Society, on the influence of a spiral conductor in increasing the intensity of Electricity from a galvanic arrangement of a single pair. As the part of the transactions which contains the paper has not yet been distributed, I regret that I am not at liberty to request you to insert the article for more general diffusion in your valuable Journal. An abstract however of the principal facts was ordered to be published, and appeared in the March number of the Franklin Journal. A copy was also sent by Prof. Bache for insertion in the American Journal; but as it did not appear in the last number, you will confer a favor by inserting it in the next.*

Should you wish to repeat the experiments, you will find them most interestingly exhibited with one of Dr. Hare's Calorimotors. If a galvanic current of very low intensity, from this instrument, be transmitted through a spiral conductor formed of copper ribbon about one inch wide, from sixty to one hundred feet long, well covered

* Then mislaid, but now inserted, see above.

with silk, and the several spires closely wound on each other, the calorimotor will be almost converted into a deflagrator. One end of the conductor being attached to a pole of the battery, and the other brought in contact with, or rubbed along the edge of a plate of metal attached to the other pole, a vivid deflagration will be produced, even when the plates are immersed in a mixture containing not more than one part of acid to five hundred parts of water.

If a copper cylinder of about two inches in diameter, and four or five inches long, to serve as a handle, be attached to each end of the spiral by an intervening piece of copper wire and thin cylinders grasped with moistened hands, a series of shocks will be felt when one end of the conductor is drawn across the edges of the zinc plates, the other end being in contact with the copper pole.

Another method of producing the shocks, is to place the spiral between two batteries each of a single pair, so as to connect the copper of one with the zinc of the other. If the extreme poles of this compound arrangement be terminated by the copper handles, and these be brought in contact, holding one in each hand, a deflagration of the metal will be produced, and a thrilling sensation, scarcely supportable, felt in each arm. The effect is much increased if the handles are rough: two cylinders of cast zinc terminating the poles, were found to produce the greatest effect when rubbed on each other.

To exhibit these phenomena in a striking manner, a galvanic battery of considerable size is required. I have used one for the purpose, containing about forty feet of zinc surface, estimating both sides of the plate. This battery was first immersed for a short time in a strong solution of acid to dissolve the coating of oxide, and then removed to a vessel containing pure water. The small quantity of acid adhering to the plates was sufficient to produce, by means of the spiral the deflagration of the metals, which would shock and snap for many hours in succession, while with a short conductor the battery in the same state gave no signs of electricity.

This will be found an economical method of exhibiting some very interesting experiments with the calorimotor. After having shown the ordinary heating powers of the instrument with strong acid, transfer the plates to a trough containing pure water, and the action of the coil may be shown for an almost indefinite time, at little or no expense of zinc or acid.

The spiral produces no increased effect when applied to a galvanic trough of one hundred four inch plates. If, however, a coil of

five or six hundred feet of wire be substituted, an increase of action will be manifest. The length of the coil must be in some ratio to the projectile force of the electricity, and also the quantity to the thickness of the conductor, in order to produce a maximum result. Thus, when a small battery is used with a large conductor, it must be charged with strong acid.

The action of the spiral conductor depends on the inductive principle of an electric current discovered by Mr. Faraday, and is consequently intimately connected with the whole subject of Magneto-Electricity.

If a magnet be fitted up in the ordinary manner, with a spool of wire covered with silk around the keeper, the intensity of the shock will be astonishingly increased, if the current generated in the spool be transmitted through a coil of several hundred feet of fine wire surrounding the legs of the magnet. It is necessary, however, to produce this effect, that the wire on the spool, and that around the magnet, should at first form a continuous closed circuit, and that this be interrupted at the same instant that the keeper is detached, so that the induced current may pass entirely through the body.

The intense shock may also be given by generating a current with one magnet, and accelerated by passing it around a second magnet.

Professor Emmet, of the University of Virginia, more than two years since, made the interesting discovery that the magneto-electric current is much increased in intensity by passing it through a portion of the generating magnet. This interesting fact, which he has applied with much success, to improve the magneto-electric machine, may undoubtedly be referred to the same cause as the action of the spiral, and I have succeeded in modifying the application of it in several ways.

These magnetic experiments were made on the first or second day of May last, while on a visit to Philadelphia, with the large magnet belonging to the museum, and kindly loaned me by Mr. Peal for the purpose. They were made with the assistance of my friend Mr. Lukins, but as I have not had an opportunity of verifying them, I cannot at present give a more detailed account. I have also made some preparations for applying the same principle to increase the action of a thermo-electric current.