SOME EXPERIMENTS WITH SMALL BATTERIES

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To illustrate the capacity and sensitiveness of the telephone, I tried a small battery made in a common tumbler with a carbon and zinc pair, and a solution of ammonium muriate as an excitant. The common sal ammoniac will answer all purposes.

This battery I included in a circuit with a Hughes microphone and a telephone; and instead of the monotonous ticking of a watch or clock, I used a musical watch with quite a range of tone. By the use of this watch the capacity of the microphone for transmitting high or low tones with their complementary overtones may be studied and regulated

With the battery above described I obtained all the tones clearly and well, and tried with it what effect different depths of immersion would have. One of the claims in Professor Bell's first patent on undulatory currents covers varying immersion as a means of varying the current, but I found very little difference in the operation of the telephone when the carbon plate was withdrawn so that nearly a corner touched the surface of the liquid in the battery. This led to the withdrawal of the zinc plate also, until only its corner touched the liquid. Under these circumstances the diminution in volume of sound was very slight, the tune coming out full and clear. The zinc plate being held clear of the solution a dead silence resulted, and the transition from this to full tone ensued with the slightest possible contact.

These phenomena led me to construct very minute batteries, and the progress step by step was very interesting. One arrangement of a pair shows the battery in, to me, a new light. It is this: Make up a circuit of a microphone, a telephone, and a continuous copper wire, and, of course, there is silence in the telephone. Cut the copper wire, and to one of the ends attach a bit of zinc. Bring the ends together again and silence ensues as before; but allow the hundredth of an inch clear space to intervene and bridge the gap with a drop of battery solution, and the telephone at once finds its voice, not loud, to be sure, but clear and distinct for most of the notes.

Such a "battery" as this may be even concealed in the connecting wire by being covered by the usual cotton or silk insulating covering, two or three thicknesses of tissue paper between the ends preventing metallic contact. A gun cap battery with zinc and sulphuric acid gives a strong current for the microphone circuit.

Discarding the zinc, as being too readily consumed, I have made pairs with carbon and gold, carbon and platinum, platinum and gold, etc., and in no case have I failed in getting results; but the currents are too weak for practical uses. Two pieces of carbon, even, have difference enough in their structure to determine a slight current appreciable by the telephone. The study of these combinations, though not of apparent importance, is interesting, and, where all are groping, may shed a ray of light upon something else.

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New Process of Simultaneous Color Printing.

Many have been the attempts so to combine the various pigments required for a polychrome print, as to reproduce them by a single impression, but the different densities and consistency of the pigments employed has hitherto found an obstacle to this desirable result. Mr. W G White, a member of the Society of Arts, has, after much time spent in experimenting, succeeded in forming such a combination of various chemicals with the colors he employs, as to render them, not only of uniform consistency, but also of the requisite hardness for the operations of cutting and combining to form the pattern desired. The prepared pigment chosen for the ground of the design is first run into a mould, so as to form a solid block about three inches thick. The pattern is traced with a steel point upon a sheet of artificial talc, made with a mixture of collodion and oil, and this is pressed upon the block, so as to leave an impression of the lines upon its surface. The pattern is then cut out of the block by a sharp steel knife mounted on the end of an articulated parallelogram, so as to be maintained in a vertical position, while at the same time having a perfectly free horizontal motion. The various pigments forming the design are then poured into the spaces cut out, a kind of mould being formed temporarily by a portion of the ground color, supplemented by strips of wood soaked in water. The paint is poured in hot and liquid, and, as soon as it has cooled, another is added, and so on, until the whole design is finished, thus forming a complete mosaic. In the case of a large subject, various portions of the block may be executed by different operators at once, and then joined together; the method is also being tried, with every prospect of success, of cutting out the whole pattern in wood or metal, by means of a band saw, and then forcing the die so formed into the block of ground color, so as to stamp out the color therefrom. The mosaic, or "type," as it is called, is put into a powerful press, resembling that used by lithographers, and is first shaved by a heavy steel knife, so as to render the surface perfectly flat, level, and smooth. The material to be printed upon is then laid face downward on the slightly moistened block, and a series of rollers are passed over it once or twice, when the impression is found to have completely penetrated its substance. The print is exposed for a few seconds to the heat of a hot plate, for driving off the solvents employed, and perhaps fixing the colors, which are now found to be printed so permanently that they will stand exposure to the sun, and wear only removes them in measure as the substance itself is worn away. As a crucial test, a piece of velvet printed in this manner has been boiled for eight hours in strong potash solution, when it was found that the color had not entirely disappeared. Water color drawings and oil paintings may be reproduced by this process, so as to present the appearance of chromo-lithographs and oleographs respectively. But there is a far more extended application, in printing upon textile fabrics the designs of Gobelins and Arbusson tapestry, to form curtains, *portières*, etc. The range of materials capable of being treated appears to be very extensive, as the writer saw the same design reproduced upon fine silk and the coarsest jute sacking, both impressions presenting all the necessary sharpness of outline. This process is now worked upon quite a commercial scale, and steam and hydraulic plant is being put up at Passy, Paris, to meet the demand created for cheap reproductions of artistic designs.

Lecture Experiments.

BY R. H. RIDOUT, F.C.S.*

EXPERIMENT SHOWING COHESION IN LIQUIDS.

A shallow tray, 6 inches by 2 inches, open at one end, and lipped, is supported on three leveling screws, the lipped end being slightly higher than the other. A quantity of mercury, placed in the tray, falls to the lower end, but if now a little more be added to make it flow over the lip, the cohesion is such as to enable the descending stream to drag the remainder up the inclined plane. Water gives similar results; but from the difficulty of getting a surface which will long remain unwetted, the results are not so satisfactory.

APPARATUS FOR SHOWING ELECTROLYSIS OF WATER.

A glass bottle of 30 or 40 oz. capacity is stopped with an India-rubber cork, carrying two glass tubes, which contain hermetically-sealed platinum wires, projecting an inch at the inner side, and terminating in binding screws at the other. The vessel is filled one-fifth full of acidulated water, boiled, and the stopper inserted to cause a vacuum when cold. On connecting with two "Grove" cells, the bubbles of gas so expand as to make the whole liquid appear to boil. With either a single Grove, Bunsen, bichromate, or Leclanché cell, continuous decomposition may be obtained. When sufficient gas has collected to impair the vacuum, it may be restored by boiling.

APPARATUS FOR SHOWING ABSORPTION OF HEAT ON LIQUEFACTION OF SOLIDS.

In a differential air thermometer the usual flasks are replaced by others which have had their bottoms softened, and then introverted to form a cup or basin. In this latter water is placed, and the solid then added. Any change in the liquid's temperature is at once communicated to the air space round the cup.

PRODUCTION OF A MUSICAL NOTE IN A CONTINUOUS TUBE.

In most wind instruments the sound results either from the movement of a solid body, or the air has the choice of two directions, which it alternately takes. I find, however, that it is possible to produce a good note from a tube one-quarter inch to five-eighths inch in diameter, and from six inches to a foot long, and having a part of it contracted smoothly and evenly to about a fourth of its diameter, by blowing through it If the tube be bent upon itself at the point of contraction, the sounds are more readily obtained, though not of greater intensity.

The Heliograph.

The London *Daily News* states that they have to thank the heliograph again for an important message received from General Stewart, and announcing the result of an attack on the British troops, in which the enemy seems to have suffered severely. The message is dated Camp Ghuzni, April 22, and was received at the India Office the following day It is very probable that the news could not have been brought so speedily by electric telegraph. The heliograph does not require the route to be kept open. The line of communication cannot be cut, for the simple reason that the signaling takes place over the heads of the enemy, and the stations required are but few and far between. A ten inch mirror, and this is the diameter of the ordinary field heliograph, is capable of reflecting the sun's rays in the form of a bright spot, or flare, to a distance of fifty miles, the signal at this interval being recognizable without the aid of a glass. That is to say, two trained sappers, each provided with a mirror, can readily speak to one another, supposing the sun is shining, with an interval of fifty miles between them, provided their stations are sufficiently high and no rising ground intervenes to stop the rays. The adjustment of the military heliograph is a very simple matter. An army leaves its base where a heliograph station is located, and after traveling some miles desires to communicate with the stay-at-homes. A hill in the locality is chosen, and a sapper ascends with his heliograph, which is simply a stand bearing a mirror swung like the ordinary toilet looking glass, except that besides swinging horizontally it is also pivoted so as to move vertically as well. Behind the mirror, in the very center, a little of the quicksilver has been removed, so that the sapper can go behind his instrument and look through a tiny hole in it toward the station he desires to signal. Having sighted the station by adjusting the mirror, he next proceeds to set up in front of the heliograph a rod, and upon this rod is a movable stud. This stud is manipulated like the foresight of a rifle, and the sapper again, standing behind his instrument, directs the adjustment of this stud until the hole in the mirror, the stud, and the distant station are in a line. The heliograph is then ready to work, and in order to flash signals so that they may be seen at a distance, the sapper has only to take care that his mirror reflects the sunshine on the stud just in front of him.

*Papers read before Physical Society.

Collodion as a Generator of Electricity.

Professor Guthrie has some time since utilized the mixture of collodion and India-rubber for this purpose, and also given it a wider scope. As regards electricity, it is very remarkable that if you rub glass with the sheet of India-rubber and collodion, negative electricity is excited, where, ordinarily speaking, positive electricity is generated. One of the applications the Professor has given to this collodio-caoutchouc is the formation of miniature balloons for experimental purposes. An ordinary glass flask is first coated inside with collodion by rolling the liquid round and round inside. When dried, a layer of India-rubber is given to the collodion in the same way, and then another layer of collodion, and so on, till four or five thicknesses of collodion are reached. When dried the film is easily detached by lifting it at the neck of the flask, and pouring between it and the glass a little acidulated water. The balloon then comes out perfectly well shaped, and ready to be filled with any gas which it may be desired to try, and the neck is well secured by waxed silk or any other suitable means. In experimental physics there seem to be many useful applications of this medium, and no doubt it will come into use.

It may be used, says the *Photographic News*, to tie down the stoppers of bottles; and here its pliability is of great service, as there is none of that disagreeableness in opening a stoppered bottle which has been tied down with ordinary bladder. Photographers have before now brought into prominence some properties of different materials whose value had not been previously recognized. What would the German army, for instance, have done without the gelatine films made insoluble by exposure to light in presence of bichromate of potash? Their everlasting sausages would have had a hard time of it.

How the Waste of the Body is Thrown Off.

At a recent meeting of the Griffith Club of Microscopy (Detroit), the fascination of microscopical study was well illustrated by the demonstrations of Prof. Chas. H. Stowell, of Michigan University. Demonstration number one was upon epithelial cells, which he produced from the side and roof of his mouth with a "poetical" movement of the tongue, and deposited upon a glass slide, to all appearance, a drop of saliva. Skimming the air bubbles from the top with a pin, and removing the surplus saliva with a piece of blotting paper, he added a drop of staining fluid to better define the cells, and placing it under a microscope exhibited a multitude of thin, transparent scales, each about one five-hundredth of an inch in diameter, and containing a nucleus in the center. This he asserted was the form in which a large part of all bodies wasted, being thrown off through perspiration constantly. Demonstration number two was of glandular epithelial cells, from the scrapings of the liver of an ox, much smaller, but similar in some respects to those previously shown. Demonstration number three was of cells from the mucous membrane of the roof of a frog's mouth, which exhibited the extraordinary action of the cilia. These cells were fringed with hair-like protuberances, styled cilia, that moved with great activity and regularity, and seemed endowed with separate organic life and intelligence. The professor asserted that these cells were very common in the human body, noticeably in the bronchial tubes, where the cilia, moving always in one direction, were active in throwing off foreign substances injurious to health. Demonstration number four was of the circulation of blood in the feet of several frogs, rendered insensible by an injection of woorara.

One of the most noticeable features of the evening was the exhibition and use of twenty Ann Arbor frogs, which the professor brought with him as scientific curiosities, stating that they were a distinct variety peculiar to Ann Arbor, and of great rarity, possessing a most curious and interesting resemblance to the human body in one or two respects. Apologizing to the ladies present for so doing, the professor gathered the thirty gentlemen present at one side of the room and exhibited the distinguishing characteristics to them.

The Chulafinne Meteorite.

The analysis of the Chulafinne, Alabama, meteorite, described in our issue for May 6 last, shows the following elements:

Iron	91·608
Nickel	7·368
Cobalt	0·500
Phosphorus	0·170
	99.646

This analysis, made by J. B. Mackintosh, E.M., of the Columbia College School of Mines, is furnished by Mr. W. E Hidden.

The Millers' Exhibition.

Most gratifying reports are given with regard to the character, attendance, and promise of the Millers' International Exhibition, which was opened in Cincinnati, Ohio, May 31. In the variety and value of its exhibits it fully justifies the large expectations of its friends and promoters, and there is every reason to anticipate great national benefits to flow from it. The Exhibition will continue through June.

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