

ON A NEW FORM OF MAGNETO-ELECTRIC EXPLODER.

BY MARCEL DEPREZ.

The different models of magnetic exploders that have been invented during the last thirty years present the inconvenience of being of considerable weight and size and of giving very small sparks. On seeking to arrange an apparatus of such a nature for the purpose of inflaming gaseous mixtures in gas engines, I have reached results that are much superior to those given by the models already known, both as regards weight and the intensity of the spark obtained. A few very simple theoretical considerations led me to think that if, instead of utilizing, as done up to the present time, the current directly produced on the bobbins of an electro-magnet when the latter is suddenly withdrawn from its close contact with a magnet, the current thus produced should be sent into the conducting wire of a Ruhmkorff coil—the induced wire being employed to produce the spark—the results would be better. Such a modification of the mode of operation of the apparatus carries with it certain others in its construction and in the relative sizes of the parts composing it. As the current which traverses the inducting wire of the bobbin must have a pretty great intensity, the wire wound on the electro-magnet of the exploder must be coarse; and, besides, the breaking of the inducting current produced by withdrawing the electro-magnet must take place when such current (which leaves zero to return thither in a very short space of time) passes through its maximum intensity. It was on seeking to satisfy this last-mentioned condition that I was led to invent the new interrupter for induction coils that I have described on a previous occasion. Finally, I discovered that the electro-magnets employed in the ordinary exploders contained too great a quantity of iron, and that it would be of interest to make them much smaller. These preliminaries stated, I shall now pass on to a description of the two models that I have had constructed in order to apply the principles that I have just enunciated. The first possesses a magnet weighing 1.9 kilogrammes, and the second a magnet weighing about 8 kilogrammes.

In the first of these models, shown in Fig. 1, the armature of soft iron, B, is connected with a rectangular frame movable around the point, D. It is formed of a piece of soft iron plate bent at its extremities at B, in such a way as to fit *very accurately* against the magnet, A, whose poles have been dressed in a polishing machine. This armature is surrounded by a coarse wire (nearly 2 millimeters in diameter) connected by electric wires to the terminals of the apparatus, which are themselves put in communication with a Ruhmkorff coil of small size.*

When it is desired to use the apparatus, a sharp blow is given to the small plate, E, and the screw of the interrupter of the induction coil is acted upon until the spark assumes a satisfactory aspect. With the small model there may be easily obtained a very hot spark of 3 millimeters in length, or a very brilliant one, destitute of an aureola, whose length may reach under favorable conditions at least 7 millimeters.

When the spring of the interrupter is given a feeble tension, two sparks may be obtained—the first at the moment of withdrawing, and the second when the armature is freely abandoned to the attraction of the pencil of magnetic rays. This latter may likewise be rendered very hot if its length be limited to about two millimeters. These two sparks develop a heat sufficiently great to set fire to a match moistened with naphtha, which is something that the sparks of the Holtz machine are incapable of doing, even when several hundred of them are directed against the moistened point.

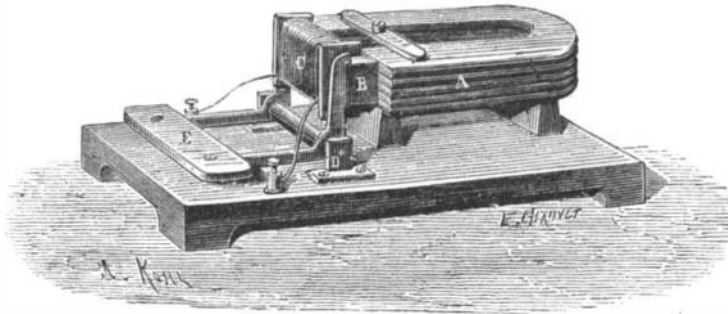
Fig. 2 represents a more powerful model of a slightly different arrangement. The armature, A, is formed of a piece of soft iron plate 6 millimeters thick and 100 millimeters long, surrounded with a coarse wire, forming a bobbin, B. The whole is firmly joined to a brass frame movable around a horizontal axis which is in a line with the axis of the magnet, C D. The latter is provided at each extremity with two pieces of soft plate iron which are beveled off at the point at which the armature, A, rests against them. There are, then, always two of these pieces in close contact with A, and two others which are not, when the apparatus is at rest. If a smart blow be given the handle, F, so as to drive it, for example, from left to right, the magnetization of the plate, A, will not only be suddenly diminished, but even reversed, since it immediately abuts against the polar pieces of contrary name to those that it touched before the withdrawal. With this arrangement, then, more energetic effects ought to be obtained than with the preceding. Nevertheless, the apparatus that I have had constructed, although having an 8 kilogramme magnet, has not given effects that were proportionally as energetic as those afforded by the small model. I

* This size is the one that gives sparks of from 8 to 10 millimeters in length.

have not been able to cause it to produce sparks exceeding 10 millimeters, whatever was the size of the Ruhmkorff coil employed.—*La Lumière Electrique.*

A New Departure in Gunnery.

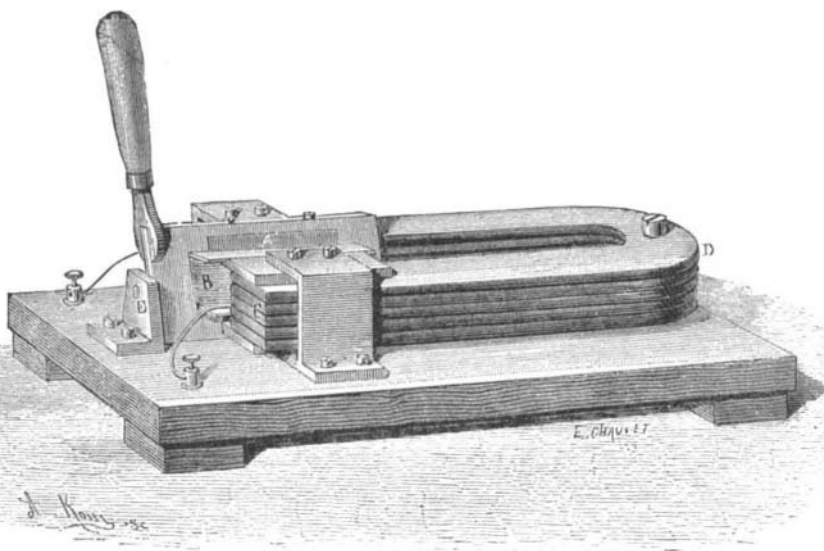
London papers state that the Superintendent of the Royal Gun Factories has adopted a new plan of increasing the initial velocity of projectiles. Having found by trial the description of slow-burning powder best adapted to his requirements, he has designed a contrivance for retaining the projectile in the chamber of the gun until the powder is sufficiently fired to set up a pressure of about two tons per square inch upon the base of the shot, which then starts at a bound, the speed of which is accelerated by the pursuit of the powder gases until it leaves the muzzle. The retention of the shot is accomplished by a ring of metal fixed around it near the base, and so regulated as to size that it will, when placed in the breach, be a trifle larger than the bore through which it has to pass. According to the resistance which it affords will be the period of retention. It has been demonstrated by experiments with fired gunpowder that in a very



NEW MAGNETIC EXPLODER.

strong vessel the powder may be ignited and converted into gas, but yet held under subjection for an unlimited time. The retention ring is made of such strength that it will surrender at a given pressure, and the requisite conditions for the attainment of maximum velocities thus appear to have been realized. With the 10.4 inch gun a 462 pound shot has been fired at a muzzle velocity of 2,275 feet per second, the equivalent of which in energy is 16,500 foot tons, but as the powder charge was somewhat in excess of the service allowance it is fair to reduce this velocity by 100 feet. It will even then be far in advance of the speed attained under former conditions. The improvement has had a stronger illustration in a competitive trial between the two experimental 45 ton guns—that of Elswick manufacture, with the air-spaced chamber, and that of Woolwich, with the retention ring.

The former, with 350 pounds of powder (rather above its service charge), discharged a 700 pound projectile at a velocity of 1,900 feet per second; the latter, crammed with 400 pounds of powder and the same shot, recorded a speed of 2,120 feet. These figures represent in energy respectively 17,500 and 20,800 tons per foot, and the advantage in an attack upon armor plates may be assumed in the same proportion.



NEW MAGNETIC EXPLODER.

This improvement in gunnery, it is said, has created great satisfaction in the government departments, and great things are expected from it.

A COLORED janitor, of Philadelphia, named Joseph W. H. Cathcart, has a curious library, which may eventually prove useful to historians. For twenty-five years he has assiduously collected in scrapbooks whatever especially struck his fancy in the newspaper press, until now he has one hundred large volumes, which he regards with affectionate pride. Three of these are devoted to "China and Japan." "Incidents in the Life of Jefferson Davis" fill two volumes; "The Freedmen's Bureau" and "Slavery" claim each five volumes. One of the most interesting collections is "Poetry of the Rebellion," which contains about a thousand war songs.

On Mines of Gold and Silver.

The following information with respect to our mines of precious metals is furnished by a special bulletin of the Census Bureau: California still holds the first place in production of gold. The vast deposits of auriferous gravel continue to yield largely, though their final exhaustion, in view of the enormous hydraulic operations now going on, must be expected at no distant day. The State furnishes 71.47 per cent of the total product of placer mines, and 51.38 per cent of the product of deep mines. The discoveries in the Bodie district added greatly to the deep mine product. The amount of silver produced is comparatively small. The gold production is \$108.30 per square mile.

The decrease of the yield of the Comstock lode has caused a considerable decline in the product of Nevada. In 1876 the Comstock yielded \$18,002,906 in gold and \$20,570,078 in silver, but in the census year the yield of the entire Comstock district and outlying veins was only \$6,922,330 for both gold and silver. The placer yield of Nevada is insignificant. No important gravel deposits having suitable water supply are known to exist.

The yield in Utah is from a comparatively few rich claims, and varies but little from year to year. The placer yield was only \$20,000. More than half the ore is milled, although the Territory's mining is generally regarded as dependent upon smelting works.

The development of the Tombstone district has given a marked impulse to mining in Arizona. The placer yield is only \$30,000.

Since 1876 the yield in Idaho has depended largely upon the old placer mines of Boise basin. The panic of 1876, in San Francisco, seriously affected the Owhyee mines, which had contributed heavily to the annual output. The proportion of placer to deep mine gold in Idaho is as 60 to 40. The census examination was made too early to include the developments in the Wood River country and the Yankee Fork region. Mr. King predicted, when he wrote the census report, that the output of Idaho would be doubled in two years.

Mining is overshadowed in Oregon by other industries. Nearly all the deep mine gold in the State is taken from the quartz veins of Baker county.

Gold quartz mining is conducted on a small scale in Yakima county, Washington Territory, and the Upper Columbia placers furnish more than one half of the Territory's placer yield.

Alaska contains many gold-bearing districts, but the yield has been small. In the census year \$5,951 in placer gold was sent to the San Francisco Mint.

Colorado had suddenly risen to the first rank as a producer of the precious metals, although as a producer of gold the State was fourth in the census year. Including lead and copper, the product was \$22,750,000. The placer yield in that year was small.

The Black Hills mines furnish Dakota's yield. The placer product was about \$50,000.

Two-thirds of the deep mine product of Montana is milled. The gravel deposits are valuable, and it is estimated that the placer yield is \$1,162,906.

The mines of New Mexico, in 1880, were awaiting the extension of railroads. Many of these mines were difficult and even dangerous of access. The Census Bureau's work there was affected by the assassination of Col. Charles Potter, the expert in charge of the Territory.

There is rich placer ground in New Mexico, but for want of water but little gold has been obtained from it.

In Wyoming the actual production was confined to Sweetwater county.

The average fineness of placer gold in the United States is 0.876. Of the ore mined in the census year, 91.39 per cent in tonnage was treated at the reduction works, and 8.61 per cent was left on the dumps. The average result of the working treatment, as compared with assay value, was 81.86 per cent of the gold contents, 79.68 per cent of the silver, and 80.40 per cent in all. The highest average yield was from the Arizona ores—\$7.01 gold, and \$86.24 silver, per ton. Of the total gold product of the country,

64 per cent came from deep mines, and 36 per cent from hydraulic, placer, drift, and river mines.

Railway Relief Fund.

The Lehigh Valley Railroad has a relief fund from which employes draw when disabled. Each employe who desires contributes one day's work, if not getting more than \$2 a day, and the company doubles the amount so raised. When the amount is exhausted a call is issued, and thus the fund is kept up. During the year ended November 30, 1881, \$24,994.58 was raised, and \$22,596.65 expended, leaving a balance on hand of \$2,403.93. Three calls were made during the year, the number contributing to the last one being 997. The system has proved very satisfactory, and has produced excellent results.

A New and Important Amendment to the Patent Laws.

[H. R. 4949. In the House of Representatives, March 6, 1882. Read twice, referred to the Committee on Patents, and ordered to be printed.]

Mr. Morgan R. Wise introduced the following bill: "A Bill to amend the patent laws."

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled: That to prevent the perpetration of fraud upon innocent purchasers of patent rights granted by the United States, it shall be the duty of all persons, before making the purchase of any such rights, or alleged rights, to require the patentee, or any person offering the right for sale, to procure and exhibit for the examination of the intended purchaser, or any person whom he may select, the original patent, or a copy of the specification and claim or claims, together with the drawings where they form a part of the specification and patent, each issued by the United States Patent Office, wherein is fully described in the specification, and in the claim or claims of which is particularly pointed out, just what was allowed, granted, and included in such patent, and no more; and if any person shall exhibit or use as a means for effecting any such sale any such specification, claim or claims, or drawing purporting or represented to have been issued by the United States Patent Office, and which was not issued from and by authority of said office, or shall so exhibit or use any patent or copy of a specification, claim, or drawing issued by said office, but which has afterwards been changed or altered in language or drawing with evident intent to thereby deceive, shall, upon conviction thereof, be deemed guilty of false pretense or forgery, according to the nature of the offense, and shall be liable to a fine of not exceeding one thousand dollars, or to imprisonment not exceeding three years, or both, at the discretion of the court.

SEC. 2. That whoever sells or conveys any interest in any patent right, or grants any license thereunder, knowing that said interest or privilege so purporting to be granted or conveyed has been previously conveyed, in whole or in part, to others, without informing the grantee or grantees of the existence and true nature of such incumbrance or prior right, so far as he has actual knowledge thereof, before receiving any payment therefor, by note or otherwise, shall, upon conviction thereof, be punished by imprisonment not exceeding three years, or by fine not exceeding one thousand dollars, or both, at the discretion of the court.

SEC. 3. That section forty-eight hundred and eighty-five of the Revised Statutes of the United States be amended so as to read as follows:

"Every patent shall bear date as of a day not later than seven months after the time at which it was allowed and notice thereof was sent to the applicant or his agent; and if the final fee is not paid within six months after the date of such notice of allowance, the patent shall be forfeited and withheld."

SEC. 4. That section forty-eight hundred and ninety-five of the Revised Statutes of the United States be amended so as to read as follows:

"Patents may be granted and issued to the assignee of the inventor or discoverer, and they may be reissued to the owner or owners of the entire interest in the patent; but the assignment must first be entered of record in the Patent Office. And in all cases of an application by an assignee for the issue of an original patent, the specification shall be signed and sworn to by the inventor or discoverer, if living; and in all cases of an application by an assignee for a reissue of any patent, the application may be made and the corrected specification sworn to and signed by the inventor or by the owner or owners or legal representatives of the entire interest."

SEC. 5. That the last sentence in section forty-eight hundred and eighty-seven of the Revised Statutes of the United States, being in the following words: "But every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force more than seventeen years, shall be, and is hereby, repealed.

SEC. 6. That no machine or other article made prior to the surrender of a patent, and the issue thereupon of a new patent, which, or the use of which, did not infringe such surrendered patent, shall be held to be an infringement of any of the claims of the reissued patent, which claims were not in the original patent at the time when such machine or other article was made. All rights of action accruing to the patentee, his executors, administrators, or assigns, for profits and damages on account of any infringement of a patent prior to its surrender for a reissue, shall remain unaffected by such surrender, and no suit shall be barred or abated by such surrender; and all suits at law or in equity may be maintained for the recovery of such damages or profits in the same manner as if said surrendered patent had not been surrendered: *Provided*, That nothing contained in this section shall apply to letters patent reissued prior to the passage of this act.

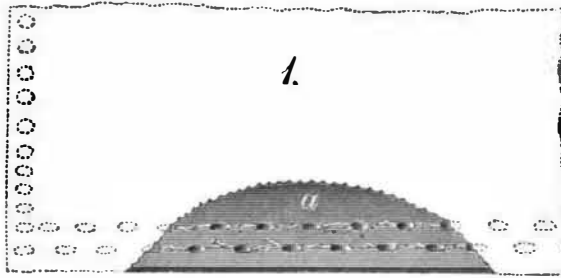
SEC. 7. That for the diffusion of mechanical knowledge and the encouragement of invention, the Commissioner of Patents is hereby authorized to furnish the weekly Official Gazette of the Patent Office, in the form and including the subjects now published therein, to subscribers within the United States at two dollars per annum, and to subscribers in foreign countries at a price not less than the estimated cost price thereof; and the price of uncertified printed copies of specifications of patents, including the printed drawings

thereof, shall be ten cents each for any number less than twenty copies, or five cents each for twenty or more copies of the same or of different patents ordered at the same time; and for uncertified manuscript copies of contents of patent files, or of any other records, the reasonable cost of making the same; and the price for certified copies shall be the same as for uncertified copies, with the addition of twenty-five cents for the certificate and seal; and all such copies of patents, or any other records in the possession of the Patent Office, when certified by the Commissioner, Assistant Commissioner, or Acting Commissioner of Patents as being correct and authentic copies of the originals in said office, shall be evidence in all cases wherein the originals could be evidence; and any person making application and paying the fees aforesaid therefor shall have certified copies thereof.

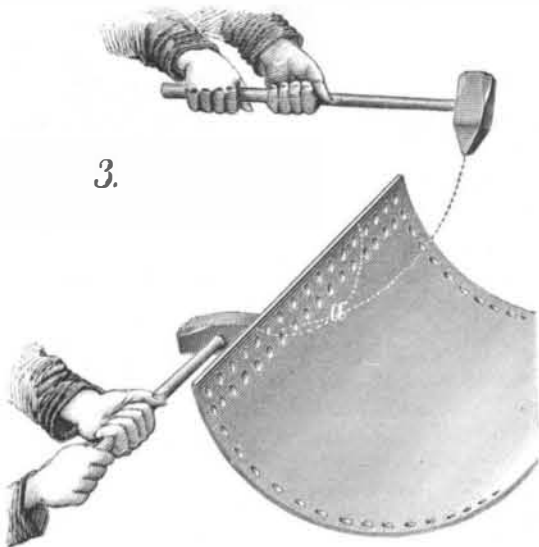
SEC. 8. That all acts and parts of acts in conflict with the provisions of this act are hereby repealed; and the five sections from section forty-nine hundred and twenty-four to section forty-nine hundred and twenty-eight, both inclusive, of the Revised Statutes of the United States are hereby repealed.

STEAM BOILER NOTES.

A letter from a practical boiler maker, in another column, commendatory of the verdict of the SCIENTIFIC AMERICAN on the Dayton, O., boiler explosion, contains much sensible

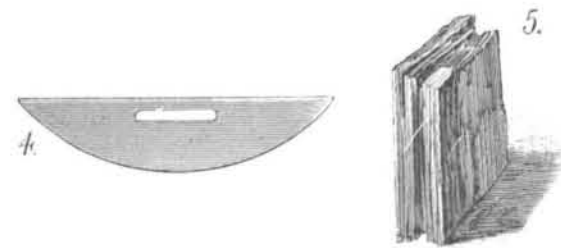


practical matter. The letter was accompanied by a sample of boiler iron cut from a three-eighths inch plate that had been worked in the boiler shop, but as it was brittle enough to crack and give a sign which was detected by the workman while undergoing the operation of fitting it for its place in a steam boiler, it was very properly condemned. The dotted lines in sketches 1 and 3 indicate its location in the plate.



The plate having been through the punching and roll bending processes, it was found, as is often the case, that the end was flat for a distance equal to half that between the summits of the lower bending rolls, see *b*, Fig. 2, page 184 of Mr. Parker's letter.

The plate was undergoing the hand process of forming the curvature at the end probably by means of sledges in the hands of the workmen, as shown in sketch 3. This



work is often done with the plate standing up on its edge, and many boiler makers use the face of the sledge instead of the "pane;" but the marks on the interior of this sample indicate that a "set" having an acute rounded angle, or else the above described method, was employed upon this sample. While this process is going on it is usually under the direction of a foreman or competent journeyman, who from time to time applies the template, sketch 4, which is a truly cut segment of the desired circle. He also indicates by touching the plate with the end of his template or a stick where he wishes the next blow to fall.

It will doubtless occur to some practical readers that this method not only produces imperfect results, but that it is severe on the iron, particularly when heavy blows are struck with the "pane" of a sledge hammer. This is true, because the plate having been punched is less able than a whole

plate to bear the strains of bending in this violent manner. Some iron, having a ductile "skin," might, if more gently dealt with, be able to endure hammer bending and give no sign upon its surface, though seriously injured in its interior.

It is plain, however, that iron that will not endure gently bending to a slight curve without injury after being punched, is totally unfit for boiler construction, though it might stand a tensile strain of fifty thousand pounds per square inch in a testing machine, which always gives a steady and slowly increasing pull in a direction parallel to its plane surfaces.

The piece of iron represented by sketch 5 was sawn from the ruptured edge of the plate that first gave way and caused the explosion of the Dayton boiler. The crack that is spoken of as being older than the date of the explosion was at the "calking edge" of a double riveted longitudinal seam, and this crack formed one of the boundaries of this sample. It was situated just over the line from the end of the plate. It has been digested in the bath for some time.

It will be observed that the better portion of the plate at the two surfaces has been less wasted than the poorer, probably not so snugly piled, and therefore more porous interior, about a third of the thickness. Perhaps the inferior middle portion has also been rendered more open by the hinge bending that it suffered while in the boiler, and by blows of the hammer in setting the curve by hand.

The Sugar Test Decision.

The long controversy with regard to the right of the Treasury Department to apply other than color tests in determining the grade of imported sugars, has at last been decided by the United States Supreme Court, and decided in favor of the position taken by the importers.

The opinion of the court describes the question at issue to be whether the dutiable quality of sugars is to be decided by their actual color graded by the Dutch standard, or by their saccharine strength as ascertained by chemical tests. "The defendant in error maintains the former, the plaintiff in error the latter. The test prescribed by the statute is the Dutch standard of color. If Congress desired the application of the chemical test, why did not Congress say so? Color was the standard which Congress, with the light which it had, saw fit to adopt. If it be found by experience that that standard is a fallacious one can the Executive Department supply the defects of legislation? Congress alone has authority to levy duties. Its will alone is to be sought. It appears very clear from the evidence that the Dutch standard is a color standard only. As applied to the sugars of the Island of Java brought to the mother country it was undoubtedly a very fair standard of the quality of sugar. With new processes of manufacture, however, and with the present perfection of the refining process, color has become a matter of little consequence, provided the sugars contain abundance of saccharine matter. The color standard has come to be a very precarious one. Still, if the government chooses to adhere to it, it is bound by it. If Congress, as it has done, adopt the color standard, it is not for the customs department to adopt a different one. When Congress chooses to do this it will be time enough for the Custom House to follow."

Justices Matthews and Harlan dissent from the opinion of the majority of the Court, on the ground that a color imparted to sugar artificially either during the process of manufacture or after its completion—a color which it would not contract by means of any of the processes necessary merely to the production of sugar—is not its natural color and not the real and true color of the Dutch standard.

Red Snow.

At a recent meeting of the San Francisco Microscopical Society, Dr. Harkness presented a bottle of "red snow," which he gathered last June on the Wasatch Mountains. The red snow was found on the north side of a spur which rose about 10,000 feet above the sea level. When fresh, the snow has the appearance of being drenched with blood, as though some large animal had been killed. The "red snow" is caused by the presence of a one-celled plant called *Protoococcus nivalis*, which reproduces itself by subdivision; that is, the cell divides itself into several new cells. This is done with great rapidity, and a few cells lodged in the snow, under favorable conditions, soon will give it the appearance called "red snow." It was remarked that the phenomenon of red snow had been observed from the earliest times, as Aristotle has a passage which is thought to refer to it. The subject was, however, lost sight of until brought up by the investigations of Sanssure, who found it on the Alps in 1760. He made chemical tests which showed him that the red color was due to the presence of vegetable matter, which he supposed might be the pollen of some plant. In 1819, an Arctic expedition under Captain Ross brought some specimens from the cliffs around Baffin's Bay, and they were examined by eminent botanists, some of whom mistook the nature of the plant, and there was long discussion as to its proper classification, some holding it to be a fungus, some a lichen; but it was finally set at rest as one of the unicellular algæ. It is of interest also that some of the early examiners pronounced the color due to animalcules, but this was disproved. Dr. Harkness said that during his last visit to England he saw the original bottle of specimens brought from the Arctic more than sixty years before, and in which the *protoococcus* could still be seen with the microscope.