THE NORTHERN LIGHTS.

When, in 1752, Franklin succeeded, through a kite sent up into a storm cloud, in obtaining an electric spark at the extremity of the cord, which had been made a conductor through the rain, it was no longer possible to doubt that lightning was but an immense electric discharge between two clouds, or a discharge between a cloud and the earth. This discovery was of great importance, since it connected with the laws of physics certain phenomena which, until then, had passed for marvelous, and in which nothing but supernatural and mysterious manifestations were seen.

The aurora borealis, which is more difficult to understand, and which necessitates more extended scientific notions, has remained much longer unexplained. This enigmatic phenomenon was especially striking to the imagination of ancient peoples. It was regarded as an omen of inauspicious events, and the historians who describe it affirm that, at times, armies have been seen passing through the bloody heavens, and that the clash of arms has been heard.

It is now known that the aurora borealis has the same origin as lightning, that it is one of the visible manifestations of atmospheric electricity, and that it is due to slow movements of that fluid, while lightning is the result of violent motions. The effects of the aurora and of the thunderbolt are absolutely different; but between them there is an intermediary that connects them, and this is heat lightning.

These elementary notions are now the property of science; but the study of the aurora has hitherto been only partially outlined. Travelers and physicists have, indeed, given numerous descriptions, but it has remained to find the bonds that unite these so important phenomena in the economy of the globe, to study the causes that set them in action, to observe the correlations that they may offer, and to discuss theories. This is a labor that Mr. S. Lemstrom has been engaged in for several years, and we now propose to analyze the results published by this great Finnish physicist.

The author of this important work, who has long been occupied in the study of the aurora borealis, so frequent in his country, was attached to the polar expedition made in 1868 by Nordenskjold. He was led to begin a series of important observations. In 1871 he visited Finnish Lapland, and, after a series of ingenious researches, constructed an apparatus that permitted him to artificially reproduce the light of the aurora, and to present science with a summary of new and incontestable facts.

Mr. Lemstrom has observed a large number of auroræ, and before touching upon theoretic questions, we shall give his description of one of the phenomena that seems to him to be the completest. On the 18th of October, 1868, the steamer Sophia was nearing the coast of Norway, after battling with a furious sea for three days in succession.

"To the west of the horizon we remarked two strata of clouds that were clearly separated by a blue band of the heavens, crossed by a band striated with a pale yellow. It was the feeble beginning of an aurora, whose splendor was soon to surpass all the phenomena of the same kind that we had up till then observed. The edges of the upper stratum of clouds gradually lighted up, and we soon saw isolated flames issuing from them that sometimes rose to the zenith. Suddenly, the phenomenon embraced the entire horizon. Everywhere were flames, everywhere were jets of brilliant light, yellow below, green in the center, and reddish violet above. In an instant, all the rays united in a regular and dazzling crown, situated in the heavens to the south of the zenith. When the phenomenon reached the maximum of its intensity, it reminded us of the immense vault of a temple, with a brilliant chandelier in the center. The apparition lasted but a few minutes, but, on vanishing, left behind it a luminous zone between the banks of clouds. From the upper bank there continued to emanate, at short intervals, isolated rays that rose to the zenith, and there formed the fragments of a crown. The edges of the banks of clouds remained luminous, although the rays had disappeared."

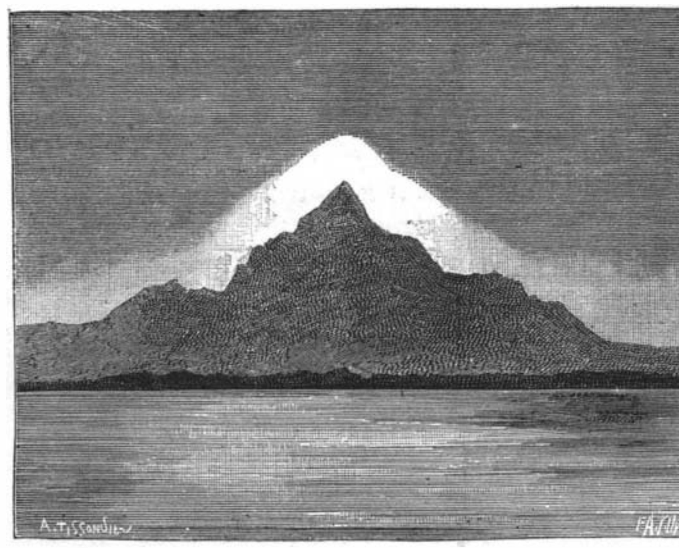


Fig. 4.—AURORAL LIGHT AROUND THE SUMMIT OF A MOUNTAIN.

According to Mr. Lemstrom, Fig. 1 gives an idea, although a feeble one, of the phenomenon at its height. It reproduces only half of the horizon, and the reader may supply the missing portion of this grand spectacle in imagination. The streams of light verging toward a common center were alternately rose colored and pale yellow, and overlooked an immense violet zone. The rosette in the center was of a beautiful red, and stood out upon a greenish blue circle.

Fig. 2 represents an aurora that was observed on the 19th of November, 1871, in Finnish Lapland. At the beginning, and at 30° above the horizon, it formed an arch from whence rose waves of light, and which gradually ascended. The figure shows it when it had reached about 60° above the horizon. The base of the aurora was yellow, and the oblique and very brilliant rays were, slightly higher up, rosy, violet, and blue. The colors of the polar light are usually clear and bright, but never did they exhibit greater luster than on this occasion.

Fig. 3 gives an idea of the variety of forms that the phenomenon may affect. It represents an aurora that was observed at the presbytery of Enare on the 16th of November, 1871. The aurora this time took on the form of a glowing red band, curved as shown in the figure. The two extremities bordered on yellow and green.

There is another form of aurora frequently observed in northern countries, and that is the one that is seen to occur above clouds, and that has the appearance of a wide piece of drapery with undulating folds. As it is the form most usually represented, we shall not dwell upon it. On the contrary, we shall speak of other phenomena of the same origin, and much less known, that Mr. Lemstrom describes. It concerns those auroral lights that shine at the edges of clouds, or that form around the tops of the mountains in Spitzbergen or in the Alpine districts of Lapland. According to the Finnish observer, it would be impossible to tell by the naked eye whence this light comes, but, by means of a spectroscope, we find that it is of the same nature as the aurora. Sometimes, these strange lights take on the form of flames of but little brightness, which, at short intervals, rise from the crest of the mountain and suddenly vanish (Fig. 4).

These phenomena sometimes exhibit themselves at the level of the earth's surface, or upon the roofs of houses.

Finally, Mr. Lemstrom describes the diffuse light which sometimes fills the atmosphere of the polar regions, thus proving that the phenomenon shows itself from time to time in the vicinity of the earth itself.

Fig. 2.—AURORA BOREALIS OBSERVED IN LAPLAND.

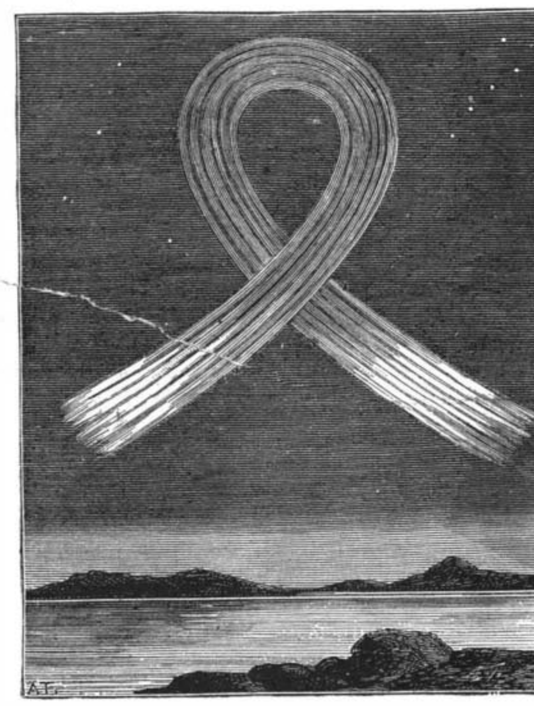


Fig. 3.—AURORA BOREALIS OBSERVED AT THE PRESBYTERY OF ENARE.

Meteors of the same nature as the light of the auroræ boreales do not occur solely in the polar regions, and the author demonstrates, not without attaching much importance to it from the standpoint of the theories to which he has been led, that they are observed in other countries of the earth. In Peru, Bolivia, and Chili the summits of the mountains are often seen illuminated by a brilliant light. This light, which occurs especially in summer, has been compared to heat lightning by scientists.

Similar observations have been made in the Swiss Alps. Dr. De Saussure has seen electricity escape through all the projecting parts of objects, and the same phenomena have been observed upon the high plateaus of Mexico. Again, we may cite the fact that Brewster observed a light upon a church tower during an aurora borealis. In every country phenomena similar to polarized light may occur.—*La Nature.*

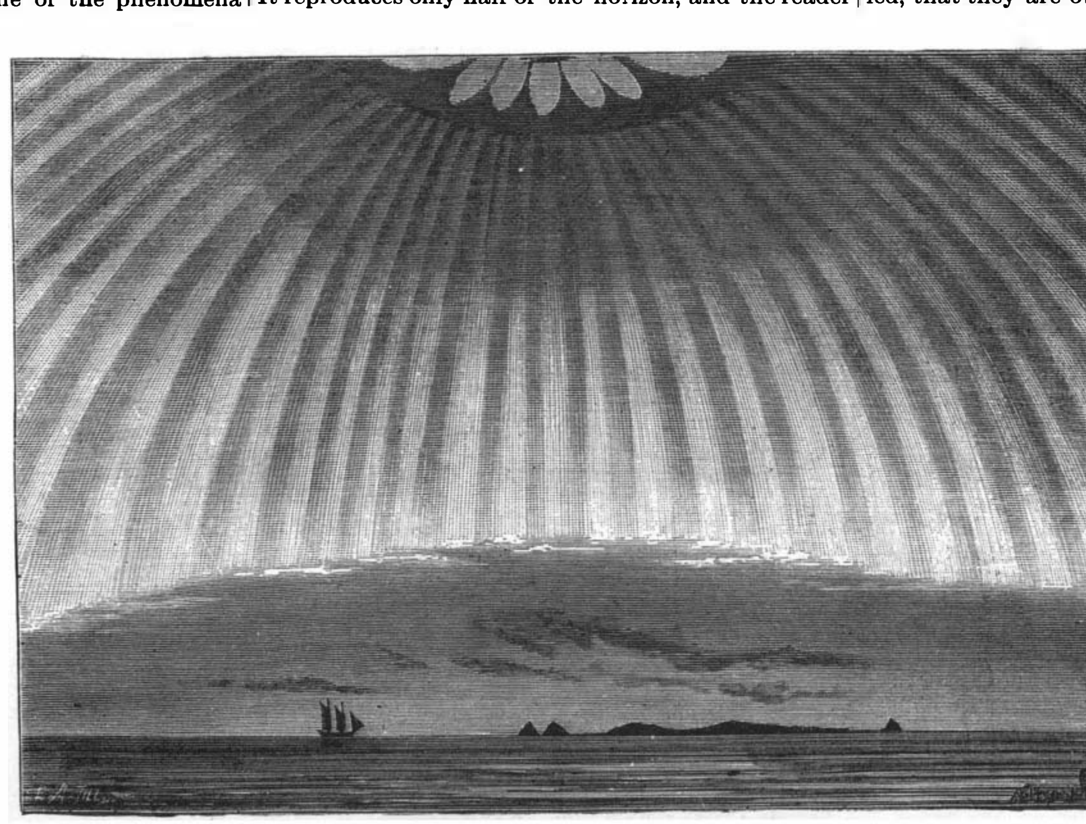


Fig. 1.—AURORA BOREALIS OBSERVED NEAR THE COAST OF NORWAY.

IN 1886, 17 Gloucester fishing vessels were lost, worth $115,800, and 115 fishermen never came home. The year was remarkable for the small inshore catch, almost all the fishing being done on the high seas.

The Latest Yankee Craze.

At the forthcoming American Exhibition in London, we are promised, among other novelties, a house of straw, which is now being made in Philadelphia. This house is to represent an American suburban villa, announced to be "handsome and artistic in design," two and a half stories high, and covering a space of 42 feet by 50 feet. It is constructed entirely of materials manufactured from straw—foundations, timbers, flooring, sheathing, roofing, everything in fact, including the chimneys—the material being fire proof as well as water proof. The inside finish is to be in imitation rosewood, mahogany, walnut, maple, ash, ebony, and other fine woods, the straw lumber taking perfectly the surface and color of any desired wood. This straw house is, in the first place, to illustrate Philadelphia's commercial, financial, and industrial interests by means of large photographs of the leading buildings; but it will also demonstrate how far the inventive Yankee has succeeded, not in showing us how to make bricks without straw, but how to produce timber from straw. If, after this brilliant exhibition of inventive genius, we do not bow down and worship him as the "licker" of creation, we may consider ourselves lost to all sense of what is proper under the circumstances.—*Iron.*

EFFECT OF A TORPEDO ON AN IRONCLAD.

The British government lately strengthened up the bottom of the old ironclad Resistance, and tried the effect of firing off a 90 lb. guncotton torpedo against the vessel. To the surprise of every one, the ship was not seriously damaged. The *Engineer* comments upon the experiment as follows:

The Resistance experiments so far tend to demonstrate that the total disablement or destruction of a modern ironclad is not so easy as many people imagined. It was too hastily assumed that the explosion of a charge of 90 lb. of guncotton in contact with any portion of the hull under water would have such destructive effect as to overcome the protection afforded by a thick lining of coal and the cellular system of construction now always adopted in vessels of war. There are, however, certain considerations attached to this experiment which, if duly weighed, should reassure the advocates of the torpedo, and restrain the exultation of naval architects within reasonable bounds. We shall endeavor to place these before our readers briefly and impartially, reserving a fuller summing-up until the remaining experiments are concluded, as they are of greater importance than any of those preceding. It is the more essential to do this because the *Times*, in a leading article of November 3, leads us to believe that as this attack failed, in the broad sense of the word, similar attempts under different conditions would have a like result; and that although serious damage would be caused, the ship would remain "floating and seaworthy, with her offensive powers not materially impaired." We are not prepared to accept this conclusion, for the following reasons:

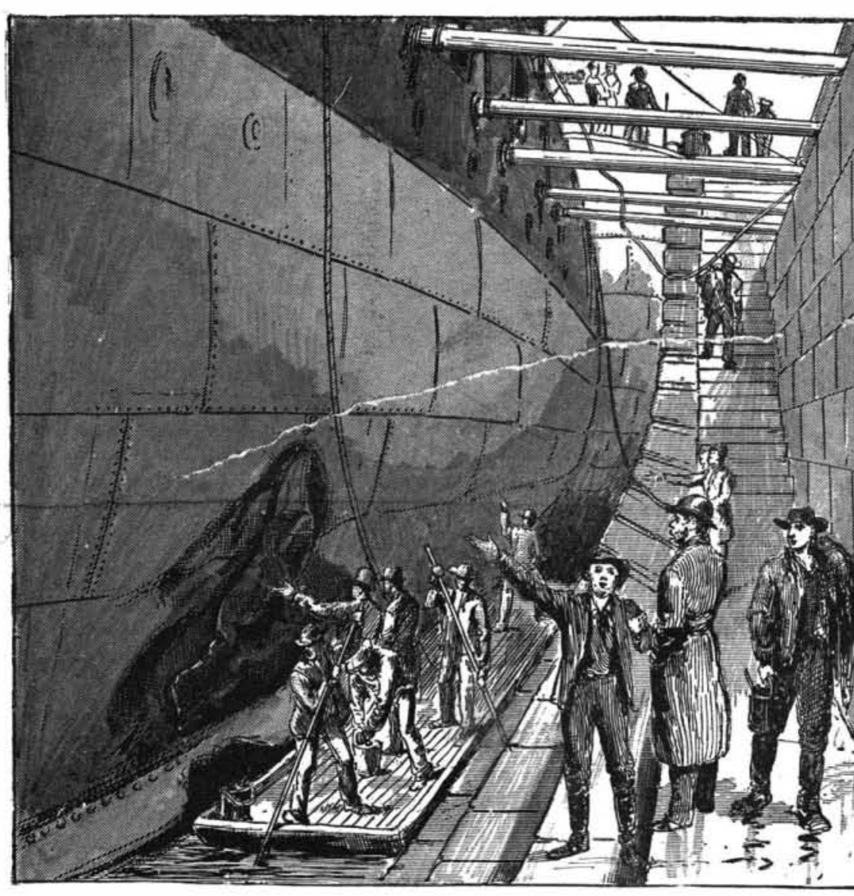
First, let us consider the general effect of a submarine explosion. It closely resembles the action of gunpowder when ignited in a gun. We know that in the latter case a quantity of heated gas is formed, which in its power of expansion exerts force in all directions. Prevented from expanding by its rigid confinement, except in the direction of the bore, the gas attains its object by the displacement of the projectile. This is, in fact, the line of least resistance. When the same explosive is ignited under water, the heated gas presses outward in all directions, forcing the surrounding molecules of water against their neighbors, which are, in turn, propelled forward with great violence. This effect continues until the back pressure of the liquid medium equals the now reduced pressure of the gas due to its expansion in the space vacated by the displaced water, which is likewise to some extent compressed by the action of the gas. Though brought actually to a state of rest, the surrounding water is under the influence of great pressure, which by the law of fluids is transmitted equally in all directions. When a vessel is sufficiently near the explosion to be struck by the water which has been so violently disturbed, it will act upon her like a huge projectile, and it is obvious this range will be in proportion to the amount of explosive employed. This, combined with the resistance her hull offers, will also determine the effect produced.

If the charge is too near the surface of the water, the liquid layer above it will not restrain the liberated gas sufficiently to allow of its full power being exerted in other directions, and hence permits its escape into the atmosphere, throwing up the water in its way to a greater or less height, according to the thickness of the layer. The spectacular effect, therefore, afforded by the upheaval of a large and lofty column of water is no criterion of the efficiency of a submarine explosion, but, on the contrary, shows that much of its energy has been expended in the wrong direction. The amount of submersion to give the greatest lateral effect to different charges of explosive has been ascertained by practical experiments. For 100 lb. of gunpowder, it is stated to be 10 ft., while for the same quantity of guncotton it should be 15 ft. As the charge employed against the Resistance was 90 lb. of guncotton placed 10 ft. below the surface, it is probable that some loss of power was sustained in the manner we have indicated. At a greater depth also the charge would have been to some extent under the vessel, where its explosive effect would have been more severe, and where the construction of the hull cannot be as strongly fortified with coal as was the case in the Resistance. We are unable to state why a depth of 10 ft. was selected on this occasion; but it may be due to the fact that up to a late date most of our locomotive torpedoes have not carried a larger charge than 40 lb. of guncotton, and are usually run at 10 ft. below the surface.

Considerable stress has been laid on the fact that in this experiment the charge was in actual contact, and yet did not effect complete penetration. It is even gravely asserted that an actual torpedo would have rebounded a certain distance before explosion took place, and this would diminish its effect. In the first place, the detonation of guncotton is practically instantaneous, so that impact and explosion would be simultaneous. We are hardly prepared to allow an inch rebound, but will concede that until actual proof convicts us of error. In the second place, it is possible that a distance of three or four feet between charge and ship would rather augment than diminish the effect produced in the case of such an explosive as guncotton when sufficiently immersed. It is possible the intervening water thrown against the side of the ship would do more damage than the gas liberated in actual contact. At any rate, experiments some years ago with smaller quantities of both dynamite and guncotton showed that when exploded 4 ft. from the bottom of a ship, enormous damage was inflicted on her.

Although it is generally estimated that guncotton is about four times more powerful than gunpowder, this does not appear to hold good under all conditions; while, on the other hand, for certain purposes, ten times the amount of gunpowder would not produce the same result. This is proved by the ease with which the strongest chain cable and wire rope can be ruptured by a small charge of guncotton, which even more than ten times the amount of gunpowder could not accomplish. This is due to the peculiar shattering action of detonated guncotton, which the slower burning substances does not possess, its characteristic being more of the nature of a push than a blow. Taking into consideration the method in which the hull of the Resistance had been strengthened for this experiment, and the exact locality chosen for the explosion, it is probable that less than twice the amount of gunpowder would have caused a more complete breach through the coal protection. The torpedo is stated to have had everything in its favor; whereas, in our opinion, all the advantages were on the side of the ship. The attack was made at her strongest point, where the coal was specially disposed, and her shape under water lent no assistance to the explosive. To assume from this that if a similar torpedo struck lower down, or further aft, or against the propeller, the ship would still have "her offensive powers not materially impaired," is to express an opinion with which few will be found to concur.

Under the alternative circumstances mentioned, half the amount of explosive might practically disable the vessel, though her flotation need not be overcome. Whitehead torpedoes need not necessarily be limited to a depth of 10 ft., as by slightly strengthening their construction they could be run 20 ft. below the surface. We presume it will be allowed that this would increase their destructive power, especially in the vicinity of engines and boilers, which now occupy so much space. In a similar manner there is no difficulty in increasing the charge of a locomotive torpedo to a point at which it becomes irresistible, whatever system of internal protection may be devised. This has, in fact, been going on for some time; more than one nation possesses torpedoes armed with 100 lb. of guncotton, and if we do not, it is simply because former experiments led us to believe sufficient damage would be caused by a less quantity. We can only consider that disproved on demonstration by further trials under conditions less favorable to the ship, and we venture to predict some delusions will then be dispelled which this particular experiment seems to have occasioned.



TORPEDO EXPERIMENTS AT PORTSMOUTH—DAMAGE DONE TO THE PORT SIDE OF H.M.S. RESISTANCE.

Steel Wire Brush Patent.

Before Judges McKennan and Acheson of the United States Circuit Court for the Western District of Pennsylvania, at Pittsburg, Pa., No. 16 of November term, 1886, a question arose as to whether a steel wire brush for cleaning castings, and a steel wire brush for cleaning boiler flues, was an infringement on what is generally known as the Wright patent, No. 59,733, and the reissue, No. 2,598, owned by Joseph McArthur, of New York city.

The Wright patent consists of a wooden block with a series of pairs of holes. A bundle of wire splints is doubled and the ends inserted in the holes, being held by the wooden bridge between the holes and by a wooden back screwed to the block.

Joseph H. Davis, of Sewickley, Pa., the defendant, under his casting brush patent, No. 232,600, the construction of which consists in the doubling of the wire splints and inserting in one hole of a wooden block, and fastening by means of weaving a wire through the loop, the wire being held in place by a wooden back fastened on by driving wrought iron nails through the block and back and clinching on the back, thus making the block and back practically inseparable.

The Davis flue brush patent, No. 181,416, is made by sticking the wire splints through holes in an iron cylinder, there being no wood about its construction.

Several cases had been tried in other States involving the validity of the Wright patent, which had resulted in Mr. McArthur's favor, but after exhaustive argument in the case at Pittsburg, Pa., the court held the Davis brush not to be an infringement on the Wright patent.

How Long Should a Nervous Patient be Treated?

The question of how long treatment should be continued in a neurotic case when no evident benefit is produced has recently been raised in a Hamburg law court. A medical man, says the *Lancet*, having as a patient a merchant suffering from "nervousness," treated him by galvanism. Altogether he galvanized him 445 times, but the nervousness did not disappear. Then came the matter of fees. The sum claimed was $556. The merchant disputed this on the ground that the treatment ought not have been continued so long, as it was not producing any benefit. The court referred the matter to the medical board, which gave as its opinion that the doctor ought to have asked the patient, after some fifty sittings, whether he would like to continue them, as it was doubtful whether the treatment was doing any good. The court, however, declined to accept this view, holding that it was for the patient to say when he had tried the treatment as long as he was disposed to pay for it, and so gave judgment for the full amount claimed. This judgment seems to accord with the principle that applies to newspaper subscriptions. A man must pay for his paper as long as he takes it from the post office.