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OPTICAL TELEGRAPHY.

Men have, from the most remote epochs, endeavored to communicate with each other from great distances, and the first telegraphs were probably based upon optical signals. They were doubtless very imperfect, and could not be used for transmitting words, but they sufficed to announce in a general way that such or such an event had occurred. Upon reading ancient authors, we find that the Greeks and Romans lighted upon high mountains, or upon towers constructed for the purpose, fires which had a significance. It may be said with truth that in all times and among all peoples, even among savages, we find a trace of this idea.

Toward the sixteenth century the system of corresponding to a distance seems to have been improved, and we find different proofs of experiments made in this direction. Since that epoch use has been made of opaque objects, such as wooden panels painted black or white, which, according to the way in which they are arranged, have various significations. This is the system now in use in the marine. As well known, in fact, vessels communicate with each other and with ports by means of flags by day and of lanterns by night, which, according to their relative positions, indicate certain numbers that correspond to those of an international code, in which there are about 80,000 phrases that can be used for communicating at sea.

Other systems, which perhaps would have proved very practical, have been proposed at different epochs, but have not been adopted, for the most part because they have not been carefully examined, or because the great advantage that could be derived from them has not been understood.

It is to a Frenchman, Claude Chappe, that is due the honor of having invented and set up the first apparatus that were capable of being used practically for transmitting the usual alphabet, and consequently any dispatch whatever. This telegraph consisted of three strips of wood hinged to each other. The largest of these carried the other two at its extremities, and was attached by its center to the top of a mast situated upon an eminence. The different combinations that could be obtained by the relative positions of these three pieces were numerous enough to allow of a complete reproduction of the alphabet and of certain conventional signs. As every one has seen this system, if not in reality at least in engravings, we shall not dwell upon it.

The first dispatch was sent September 1, 1794, from Lille to Paris in a few hours. It announced to the Convention that the city of Conde had just been retaken from the Austrians. This was a good inauguration of so fine an invention.

The Chappe system remained in use till the invention of the electric telegraph, which gradually caused its predecessor to be abandoned, and even forgotten. It seems to have been used for the last time during the Crimean war, where it was employed as a field telegraph. After this, save in the case of a few applications, it entirely disappeared.

Optical transmissions, however, have, over electrical ones, an advantage that in certain cases must make them prevail, and that is that they require no wire or other material connection between the two stations. During the war of 1870, while Paris was invested and cut off from the entire world, regret was felt that the system had not been preserved and improved. The idea was taken up at this moment, but too late!

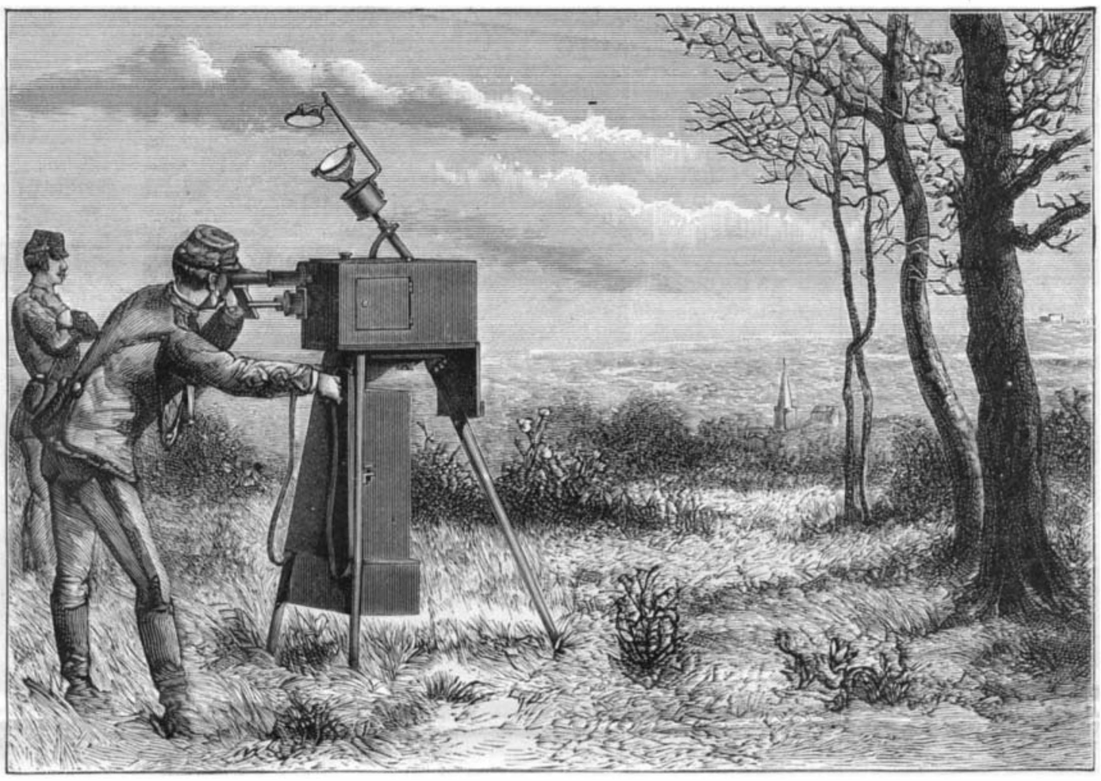

Fig. 1.—MILITARY OPTICAL TELEGRAPH WITH HELIOSTAT.

If, at this period, we had had at our disposal the simple apparatus that are now employed, and especially if their use had been better known, men certainly would have been found who, even placed in the midst of the enemy's lines, and at the risk of their life, would have endeavored, and successfully, to put the capital in communication with the rest of France. Every one will understand the immense advantages that could have been derived from such a result, when it is remembered with what anxiety the balloons and carrier pigeons were awaited on every hand, and with what enthusiasm they were received. So at this epoch the idea was taken up again. Many systems were proposed and tried, but time was wanting for the construction of the apparatus, the selection of stations, the instruction of operators, and it became necessary to abandon them. To-day the optical telegraph is sufficiently perfect, and is beginning to be used enough to allow us to hope that a like state of things shall not occur again.

Communications to a distance of 12 and 30 miles are easily enough established with simple apparatus, if time permits of it; and, in many cases, with an appropriate plant, enormous distances may be reached. Since the end of 1884, Mauritius and Bourbon Islands, 108 miles apart, have been thus connected by the persevering cares of Messrs. Adam and Dubuissen. The principle of the modern optical telegraph is based upon the emission of luminous rays for a certain length of time, according to the laws of the Morse alphabet. It consists, as well known, in combining dots and dashes that permit of representing all the letters of the alphabet and certain conventional signs. A very short flash corresponds to a dot, and a longer one to a dash.

The apparatus now used are of Col. Mangin's invention. There are two kinds of them, one of them light and particularly suited to field work, operating with lenses, and the other, heavier and more cumbersome, employed in fixed stations and in forts, and operating with mirrors or telescopes.

The lens apparatus (Fig. 3) consists of a sheet iron box, A B C, containing both the transmitter and receiver. The latter consists simply of a telescope, R, fixed to the upper left angle of the box. The transmitter is based upon the property that biconvex lenses possess of concentrating at a point called the *focus* the parallel luminous rays that reach them, and, conversely, of sending out a fascicle of parallel rays when a luminous source is placed in their focus. It is unnecessary to dwell upon this point, for who does not remember having amused himself in childhood in lighting spunk or paper by means of the rays of the sun concentrated by a lens?

Fig. 2.—MILITARY OPTICAL TELEGRAPH WITHOUT HELIOSTAT.

At the back of the box, then, there is a biconvex lens, L L. The diameter to be given this varies with the power to be obtained. In the smallest model it is 5½ inches, and in the largest 15¾. In Fig. 3 it will be seen that alongside of it there is also placed a second lens, L′ L′. The object of this arrangement is to diminish the focal distance, thus permitting of making the box shorter; but this in no wise changes the principle of the system. The luminous source is placed in the focus thus obtained. Up to the present, when the sun has not been employed, a kerosene lamp has given the best result. This is easily used, and its light is bright enough to be seen to a distance of 24 or 30 miles with 15¾ inch lenses, and, moreover, kerosene is now to be had everywhere. It is, then, an eminently practical luminous source for

(*Continued on page* 148.)

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OPTICAL TELEGRAPHY.

(*Continued from first page*).

an apparatus which, like the one under consideration, is called upon to operate in the field. The lamp is furnished with a reflector, *r*, and a chimney, *m*, of sheet iron, provided opposite the flame with apertures in which glass is inserted. A groove in the bottom of the box allows of the passage of a screw, H, that serves to fix the lamp when, after experiment, the focus has been found. For this purpose the reflector is removed, and into the socket, T, there is introduced a tube, which is shown at I in Fig. 3. This carries at one extremity a system of lenses, and at the other a piece of ground glass. The end containing the lenses is turned toward the lamp, and the latter is moved until the flame is projected in the center of the ground glass.

This regulating being finished, the tube, I, is taken out, the reflector replaced, and the socket closed. When it is desired to use sunlight, which is much preferable, as the range is then greater, use is made of the tube, I I, which, likewise, is placed in the socket, T, after the lamp and its reflector have been removed. It will be seen that by means of a mirror, *b b'*, the solar rays are sent to a lens that concentrates them at a point, *s*, situated exactly at the focus, F, when the tube is in place. A heliostat moved by clockwork, and having a play of mirrors that are used as need be, permits of following the sun in all its positions (Fig. 1).

According to the place occupied by the receiving telescope, R, it will be seen that its axis is parallel with the axis of emission of the luminous rays. If, however, the box should get out of true and the parallelism be destroyed, the trouble may be remedied by slightly moving the telescope by means of the two regulating screws at V.

In order to obtain the necessary interruptions in the emission of the luminous fascicle to reproduce the Morse signals, there is arranged at about three inches from the focus, F, a screen, E E, which has in the center an aperture a little larger than the section of the cone which goes from the source to the objective.

In front of this aperture, and at the side of the source, there is a small screen, *a*, which completely masks it. This is movable, and, by means of a play of levers, may be maneuvered from the exterior by pressing upon a pedal, M. By giving the latter a quick blow we produce a short flash, while by allowing the hand to rest upon it for an instant we obtain a long flash. This maneuver is quickly learned, and we have recently found that any one who knows the Morse alphabet can, after a few hours' practice, send and receive an optical telegram.

The telescopic or mirror apparatus resemble those that precede, in many points. We find therein (Fig. 4) the box, A B C, the receiving telescope, L, the screen, *a*, maneuvered by the pedal, M, and the luminous source, consisting of a kerosene lamp or the rays of the sun. Instead of lenses for sending the light to the corresponding station, use is made of the properties of curved mirrors. These may be considered as being formed by the union of a large number of small plane mirrors. On applying to them the well known law that the angle of reflection is equal to the angle of incidence, and on examining Fig. 4, we shall easily understand the *modus operandi* of telescopic apparatus. A large concave mirror, R, is placed at A B at the bottom of the box, B C D, its focus being at F. Here might have been placed the luminous source; but, since the lamp would have then formed a screen, and intercepted a portion of the rays reflected, it has been preferred to place it externally in a second box, *a b c d*, which is affixed to the other. This has necessitated the use of some means of bringing back the luminous point to F. To effect this, an aperture, T, has been formed in the back of the mirror, into which has been introduced a tube provided with two lenses. The distance of these from the lamp is such that there forms at the point, F, a conjugate focus of S. The luminous rays that emanate therefrom are received upon a small convex mirror, R', at the extremity, D C, of the box, and are sent from thence to the entire surface of the large mirror at an angle that is so calculated that, after their reflection, they take a direction parallel with the axis of the apparatus. From the position of the screen, *a*, it will be seen that the conjugate focus cannot form and send rays to R' unless the manipulator has been acted upon and moved from its natural position.

The signals of the Morse alphabet, then, are reproduced with the same facility as in the lens apparatus. The kerosene lamp is here again generally employed, although the rays of the sun are also used along with the heliostat. The electric light has likewise been utilized, but without much success up to the present, for want of a sufficiently practical source of electricity, and because arc lamps are not steady enough, and their flickering renders the signals confused.

These apparatus are, as we have said, designed for permanent stations. They are usually established in forts—often under a casemate—and, once regulated in a definite position, are not thereafter to be moved.

It is not the same with the lens apparatus, as these are portable and designed for operations in the field. They are placed upon a tripod (Fig. 2), whose hinged table permits the instrument to be inclined in all directions. In fact, it will be seen that this is indispensable, since the position of the correspondent is known only approximately, and must be sought. For this purpose, after fixing the box upon the table by means of three screws, the eye is applied to the telescope, and the horizon explored in the direction in which the other station is supposed to be. By using a compass and a good map the station is generally found quite quickly, especially if, as we have supposed in the two engravings, it is a question of corresponding with a station established in a fort. When once the position is determined, the table is rendered immovable by means of a screw beneath it.

The operation is more difficult when it is a question of putting two movable stations in connection with each other. In this case it is preferable to await the

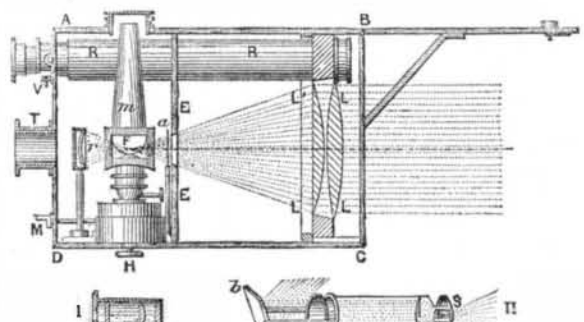

Fig. 3.—OPTICAL TELEGRAPHIC APPARATUS.

coming of night, since the light can then be better distinguished. It is necessary to have two operators for each apparatus. In fact, it would be impossible for one to remain long with his eye to the telescope, since in ten or fifteen minutes he would no longer distinguish anything. Moreover, in the receiving of dispatches the one who is observing, being entirely engrossed in catching the signals, cannot write them down, but must dictate them to his comrade in measure as he receives them. During the course of a transmission, too, the one who is doing the work must not lose sight of the other station, otherwise he may not notice that the latter is interrupting, in order to show by a special signal that the letter or signal just sent has not been understood, and that it needs to be repeated. During this time the other operator, while resting his eyes, is not idle, but is watching the flame of the lamp through a small glazed aperture in the side of the box, and keeping it in proper trim. In Figs. 1 and 2 may be seen the position of the operators for receiving and transmitting. In the first the apparatus is represented as provided with a heliostat. The tripod upon which it is fixed is of an old style, the table is not movable, and the boxes (one of them for holding the apparatus and the other for the accessories) are placed underneath.

As we have explained, it has been found more convenient to make the table very movable, and more practical to use the larger of the two boxes as a seat. As may be seen in Fig. 2, this box is provided with straps, and may be carried upon the back of a man. The smaller, which lies upon the ground, contains the kerosene can, some tools, some wicks, the regulating tools, the mirrors, and the heliostat.

Cases may occur in which one has not at his disposal so complete apparatus as the ones just described. In other cases the use of such may not appear to be necessary, on account of the slight distance between the two

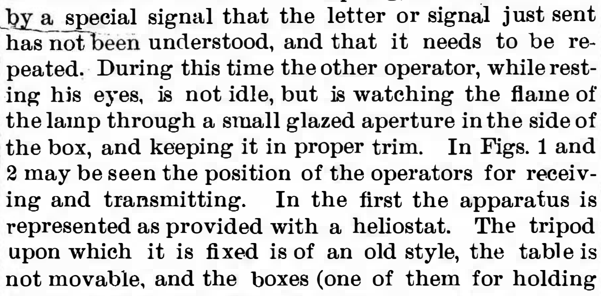

Fig. 4.—TELESCOPIC APPARATUS.

points that are to communicate, and yet it may be indispensable that the two stations, separated by some natural obstacle, like a river for example, shall be able to understand each other. Under such circumstances there may be used simple lanterns, like those belonging to a carriage. There is a small model made that may be fixed to the end of a stick or gun. In front of the glass there is a small Venetian blind, the slats of which are connected by a string that is held in the hand, and which permit, upon being opened and closed, of sending flashes of varying length. It has been found possible to communicate in this way to distances of 5 or 6 miles at night. For daytime squares of canvas fixed upon light frames have been used with success. A man holding one of these squares in each hand produces signals that have the same signification as the short or long flashes of the lantern. A single screen represents the dot, and two screens the dash. With a good field glass this kind of signals can be read from very far off.

As may be seen, optical telegraphy is based upon the use of the Morse alphabet; so the study of the latter cannot be too highly recommended. It ought to be known by everybody, for who can say whether he may not some day be called upon to make use of it for the safety of the country? In the last Tunisian campaign optical apparatus was used with success. More recently, at Tonkin, it permitted Lieut. Bailly to obtain succor, at an opportune moment, for protecting the retreat from Bac-le.

The army telegraph corps, although of quite recent organization, has already rendered great services, and will be called upon to render still more yet. The officers in command of it give the greatest attention and care to the instruction of their men, and are obtaining remarkable results. In the future, sure and quick communications will be secured for all the divisions of an army corps with each other or with strongholds, and that, too, despite the presence of the enemy above their lines, and without the enemy even knowing it; for in order to perceive the signals made by these lens or mirror apparatus, one must be in the axis of the luminous rays.—*La Nature.*

The Victims of Cholera.

The cholera has taken strong hold in Spain and on the southerly coast of France this year; every succeeding report from the infected regions indicates the gradual spreading of the disease, and the mortality is becoming frightfully great.

The season is so far advanced that the apprehension of the disease spreading to these shores this year has about subsided, but that it will cross the ocean and visit us next year is more than probable; therefore municipalities and individuals should not relax their efforts to put the streets in good order, and their houses and grounds in cleanly condition. This will do more than anything to keep the disease from our doors. Cholera seems to feed on filth and to abhor cleanliness. It seems also to like the glutton and the drunkard.

Frank H. Mason, United States Consul at Marseilles, France, has forwarded to the Department of State, Washington, some practical information concerning the prevention and treatment of cholera. His conclusions are derived from the studies of the epidemic of 1884 and preceding years in that city. He says that in its choice of victims cholera is most precise and definite. With rare exceptions the victims belong to one of the following classes: Those who live under bad hygienic conditions in respect to eating and drinking and exposure; those weakened and debilitated by alcoholic excess; and those who suffer from chronic digestive weakness or derangement. Among the imprudences which become dangerous in the presence of cholera are overeating to the extent of producing lethargy or indigestion, drinking any liquid so as to check the process of digestion, eating raw vegetables in the form of salads, and, in general, the use of raw fruits, unless perfectly fresh and ripe. Drinking cold water or beer after having eaten raw fruit is a direct challenge to cholera which no person, however strong and healthy, can afford to risk. The susceptibility of drunkards to choleraic influences is proved by abundant evidences, among which may be cited the sweeping fatality of the disease wherever it attacked inmates of inebriate asylums. Anything, in fact, whether of a temporary or chronic nature, which impairs the vigor of the digestive organs, exposes persons thus weakened to choleraic attacks.

Mr. Mason gives as the most effective destroyer of cholera germs in excretions the following solutions: Solution of sulphate of copper in the proportion of not less than 2 oz. to 1 quart of water; liquid chloride of zinc, 1½ oz. to a quart of water; bichloride of mercury, ⅛ oz. to a quart of water; bichloride of copper, 2 oz. to a quart of water; sulphuric acid, 4 oz. to a quart of water. The same chemicals are used for disinfection of water closets, sinks, and all other seats of decay or infection. For washing streets and drains, sulphate of iron, 10 lb. in 220 gallons of water, or liquid chloride of zinc, 20 lb. in 220 gallons, has been found most effective and practicable. Phenic acid, in the proportion of 10 lb. to 220 gallons of water, was largely used at Marseilles last year, but the results were less satisfactory than expected, some experts even going so far as to affirm that the phenic principle preserved rather than destroyed the germs of the contagion. He says that in the face of a cholera epidemic diarrhœa is a serious illness, and should be treated accordingly. He also says that, as a popular remedy for immediate use, nothing has been found superior to chlorodyne, sold by most druggists.

Insoluble Cement from Glue.

In order to render glue insoluble in water, even hot water, it is only necessary, when dissolving glue for use, to add a little potassium bichromate to the water and expose the glued part to the light. The proportion of bichromate will vary with circumstances; but for most purposes, about one-fiftieth of the amount of glue will suffice.

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The Volga River.

The number of vessels on the Volga is only a little less than 20,000. The chief products sent up the Volga are oil from Caspian Sea, fish from Astrakhan, salt from Tsaritsin, wheat, tallow, and hides from Samara and Saratov. The cargo of vessels that reach Nijni-Novgorod is estimated at 5,000,000 tons. From this point begins the distribution of these products in the middle Russia; 1,500,000 tons reach Ribinsk, and proceed to St. Petersburg by canal systems.

Down the Volga the cargo consists of 1,000,000 tons of miscellaneous goods and an unestimated amount of timber.

The Volga River is the largest in Europe. The thankful Russian people call it the Mother Volga. The Volga begins in a marshy locality, about 150 miles N. W. of Moscow, in the Tver Government as a small stream a few feet wide, which continually grows, receiving on both sides streams and rivers, some of which, like the Oka and the Kama, rank among the largest rivers of Europe.

The length of the Volga is about 2,500 miles, its width at the middle part about 1, and in lower part about 2½ miles. It enters the Caspian Sea; by means of three canal systems it is connected with Neva, St. Petersburg, and the Baltic Sea; by another canal system it is connected with North-Dvina, Archangel, and the White Sea, and now it is proposed to connect it with the Don River at Tsaritsin, and therefore with the Black Sea.

This immense water route, however, is not without defects. Every year it becomes shallower and shallower. Below Nijni-Novgorod the Volga is navigable for the large vessels, but above that place it is accessible only for smaller vessels, and during the dry summer of 1883 it was not navigable at all between Tver and Ribinsk. In May, when navigation begins, the Volga presents a magnificent sight, swelling at some places to 20 miles in width, but the water falls rapidly, and in the middle of June shallows or sand banks are formed which obstruct navigation. If a scow runs on such a bank, its cargo must be carried over with great expense. At the sand banks near the mouth of the Kama River, this overloading amounts to 500 to 1,500 tons every summer, and there is about a score more of such banks between that place and Ribinsk. Improvements obtained by the grated dams of Engineer Jankowsky and by dredging these banks are very inconsiderable, and it appears that the only radical measure is in enforcing the law which prohibits the wholesale destruction of forests.

Another great defect is the total absence of artificially improved harbors. Very often vessels caught by an early ice in October, and compelled to seek safety in the natural harbors, are moored to the ice through the winter, and in most instances are destroyed in the spring when the ice begins to move.

Above Ribinsk the Volga is not navigable at all, and vessels proceed further north by canal systems, of which the Marunskaia system admits vessels of larger size, and carries two-thirds of whole canal traffic. This system is a part of the great water route, and to give an idea of the system itself and the difficulties which await the vessels there, we tabulate below the different parts of which the Marunskaia system is composed:

a. 222 miles of open canals, on which scows towed by horses make about 20 miles per day at the cost of 24 cents per mile.

b. 170 miles down the rivers Sweer and Neva, on which scows make 33 miles per day, at the cost of 48 cents per mile.

c. 47 miles of canals with locks, the scows being towed by man-power at the rate of five miles per day and $1.20 per mile.

d. 249 miles up the river Sheksna, by horse and steam power, at the rate of 26½ miles per day and 90 cents per mile.

e. And finally, 14½ miles of rapids on the river Sheksna, taking at least seven days and costing $14 per mile.

The slowness of navigation is due in great part to obstructions and stoppages arising from the limited capacity of the system. Plans are under consideration now for a series of improvements to increase the capacity.

But in spite of all the difficulties, the navigation on the Volga grows every year, together with growth of commerce and production of that region. The latest and most powerful impulse in this growth has been given by the rapidly developing production of the Baku oil-region, which furnishes not only the cargo, but also cheap and excellent fuel for the Volga steamers.

REDUCED postage and other causes have increased the correspondence of the world. Less than fifty years ago the average of letters received by each person per annum was only 3 in the United Kingdom, and it is now 37 letters and 4 postal cards. The latest reliable ascertained comparison (for 1882, when the average was 35 in Great Britain) gives the average per head in the United States at 21; Germany, 17; France, 16; Italy, 7; and Spain, 5.

Correspondence.

LIGHTNING PHOTOGRAPHY.

To the Editor of the Scientific American:

I inclose a photograph of a streak of real "Jersey lightning," which I was fortunate to secure at 10:30 P.M., on Saturday, Aug. 1 last, after a great many "exposures."

The writer was led to try the experiment of photographing lightning, on account of a theory which he held, that lightning traveled in a wavy line, and not in a zigzag path, as drawn and painted by almost all our artists and painters. The result of these experiments would tend to show that the above theory was correct,

although the streak in this case certainly looked to the eye as if it was a thick zigzag streak tearing its way through the sky; but I think this zigzag effect was produced by the small streaks which branch out all the way down the main stem.

Additional interest is given to the photograph on account of a horizontal streak which occurred at the same time, which is shown, very faintly, near the top of the photograph.

W. N. JENNINGS, Photographer.

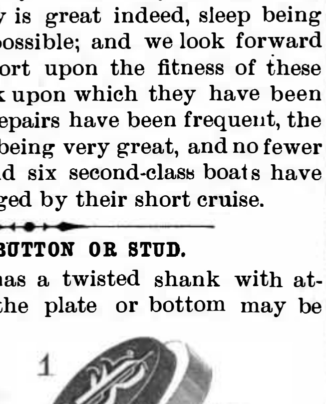
Philadelphia, August 10, 1885.

Torpedo Boats at Sea.

The records of the English torpedo boats at the recent function in Bantry is thus summarized by a London service journal: "The eight torpedo boats attached to the Hecla were terribly detached on the passage home. Only one remained near the parent ship, one made for Appledore, and has been sent for by the Seahorse, five put into Dartmouth, and one remained by the squadron. The misery suffered by the crews of these boats in a sea-way is great indeed, sleep being almost if not quite impossible; and we look forward with interest to the report upon the fitness of these little vessels for the work upon which they have been employed. Machinery repairs have been frequent, the strain upon the engines being very great, and no fewer than eight first-class and six second-class boats have been considerably damaged by their short cruise.

IMPROVED BUTTON OR STUD.

This button or stud has a twisted shank with attached plate, whereby the plate or bottom may be easily inserted into a button hole in a garment, and the button shank and plate together may be formed of a single piece of sheet metal bent into form, to be soldered or otherwise secured to the bottom of the button proper. Fig. 2 shows a bottom view of the button, and Fig. 3 the blank for forming the shank and plate in one piece. This invention has been patented by Messrs. Read Benedict and Harry M. Scott, who should be addressed for further particulars at No. 171 Broadway, New York city.



The Bryant Egg Beater.

Referring to the Bryant egg beater, engraving of which we published in SCIENTIFIC AMERICAN of August 22, we are requested to say that Messrs. Paine, Diehl & Co., 12 Bank Street, Philadelphia, Pa., are the manufacturers.

Flies and Their Relation to Disease.

It is a common belief that the absence of flies for a season is a percursor of an epidemic, and flies being this year less numerous than some other seasons, some of our contemporaries have reasoned that the cholera or some other dreadful epidemic is to inflict our land, or as one of contemporaries puts it, "without more flies, everybody is going to be sick, and a great many people are going to die." The process of reasoning on this subject is about as follows, given by a writer more rational than superstitious, which we find in the Midland *Industrial Gazette*: "The absence of flies does not exactly presage an epidemic—that is, the flies are not killed by the poison in the air, as many superstitious persons who have noticed the coincidence between disease and a small fly crop believe—but their absence is in itself a cause of sickness and epidemics. The scarcity of flies this year is attributed to the somewhat phenomenal weather prevailing in the North this spring. In February there was a remarkably warm spell, a mild temperature that hatched out most of the pupæ, and brought many of the little flies prematurely into the world. This was followed by a period of long continued and severe cold in March, which killed these young flies before they could get in their work upon the bald and sleepy. Hence a short fly crop. And now as to its relation with disease: The fly is a vulture, a buzzard on a small scale. It is the most important, because the most numerous, destroyer of pest-breeding material. It gets in on foul and decaying matter that can be reached by no other insect or animal, and it destroys it. The quantity of this pestilential matter thus removed cannot be estimated, because the fly is always getting away with it in summer, while in winter the cold prevents its evil influences being felt. When, therefore, there are too few flies to thoroughly consume all the forms of the dead and decaying substance that fills the earth, the surplus pollutes the air, the soil, and water, and creates and propagates disease. It is suggested, therefore, to New York, that, in view of its fly famine, that city stands in imminent dread of an invasion by that great enemy, the cholera, and the citizens are warned to be more than usually careful, and to supply the lack of fly by exercising extraordinary care in the removal of everything calculated to beget or nourish a pestilence."

In contradistinction to the above, Doctor Grassi, in an article in the *British Medical Journal* in 1883, on danger from flies, claimed to have made an important and by no means pleasant discovery in regard to flies. It was always recognized, said the learned Doctor, that these insects might carry the germs of infection on their wings or feet, but it was not known that they are capable of taking in at the mouth such objects as the ova of various worms, and of discharging them again unchanged in their fæces. This point has now been established, and several striking experiments illustrate it. Dr. Grassi exposed in his laboratory a plate containing a great number of the eggs of a human parasite, the *Tricocephalus dispar*. Some sheets of white paper were placed in the kitchen, which stands about ten meters from the laboratory. After some hours, the usual little spots produced by the fæces of flies were found on the paper. These spots, when examined by the microscope, were found to contain some of the eggs of the tricocephalus. Some of the flies themselves were then caught, and their intestines presented large numbers of the ova. Similar experiments with the ova of the *Oxyuris vermicularis* and of the *Tœnia solium* afforded corresponding results. Shortly after the flies had some mouldy cream, the *Oidium lactis* was found in their fæces. Dr. Grassi mentions an innocuous and yet conclusive experiment that every one can try. Sprinkle a little lycopodium on sweetened water, and afterward examine the fæces and intestines of the flies; numerous spores will be found. As flies are by no means particular in choosing either a place to feed or a place to defecate, often selecting meat or food for the purpose, a somewhat alarming vision of possible consequences is raised.

Purify the School Buildings.

The *Sanitary News* urges the sanitary examination of school buildings during vacation. To give force to its own opinion, it quotes the words of Mr. William Paul Gerhard, an eminent sanitary engineer. In a recent article on school and college sanitation, he says: "The annual vacation term would seem to be a particularly fit time to undertake a sanitary inspection of the school buildings, of their interior construction, sanitary arrangements, and of their immediate surroundings." He calls attention to the absolute necessity of such a periodical inspection, by qualified persons, and the correction of such structural and sanitary defects as may be discovered. While the water supply, drainage, and ventilation should be examined into, it is necessary to demonstrate the entire absence of dampness, and to examine the methods of lighting the class rooms, of heating the building, the means of egress in case of fire, the arrangement of seats and desks, and finally into the plumbing appliances.

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