THE ADVANTAGES OF SCIENTIFIC EDUCATION.

This was the subject of a recent lecture before the Government telegraphers of Great Britain, by Mr. William Henry Preece, who said:

"The reasons why scientific study is so little popular are that it does not appeal directly to our senses, involves time and study, and because people do not like trouble. There is, un fortunately, no royal road to learning. Knowledge is fixed at the top of a hill which requires some stiff climbing; hence science is unpopular.

A scientific man is one who knows, and one who derives pleasure from that which he knows; hence, the chief advantage which I lay before you to be gained by the study of the scientific part of your profession is—pleasure.

What would be thought of an engine driver who stuck on a bank for the want of knowing how to use sand on the rails? Such, I am sorry to say, is the position of the great majority of those who are employed in the operating branch of our department.

Education itself is an inducement to seek scientific knowledge. The object of education is to attain precision of thought, and to possess the power of drawing correct inferences from facts —indeed, to exercise judgment and common sense. There is no better method of acquiring these valuable qualities than by a scientific training. We can find out many things without scientific training—trace faults, etc.; but we can do such things more quickly, more correctly, and with more gratification, with such training. Rule of thumb methods have always a flavor of science in them; and though it has been said that an ounce of practice is worth a tun of theory, an ounce of practice *with* theory is worth a tun of practice without theory.

Scientific knowledge and training are the parents of invention and improvement, and these are the highest order of education. I do not mean scheming, or the bringing forward of novelties for the sake of novelty, often in opposition to fixed principles, but the improvement of defects and the introduction of objects of real utility. Watt has said "It is a great thing to find out what will not do—it leads to our finding what will do." When we know where the shoe pinches, we can find a remedy.

Some of the schemes which ignorant outsiders have submitted to telegraph engineers as improvements are simply ridiculous. I can remember, when the Atlantic cable of 1858 failed, a lady writing and suggesting that cables should not be submarine but super-marine—that they should be suspended above the ocean; and she suggested that the Rock of Gibraltar, the Peak of Teneriffe, and the Andes formed conspicuous objects for this purpose! Again, when we suffered so much, a little later, from the rupture of our light cables in the North Sea, an officer of one of the scientific corps of Her Majesty's army thought that he had made the grand discovery that the world was growing, and that it was owing to the continents separating themselves further and further by the growth of the globe that our cables snapped! Many suggested that the Atlantic cable should be suspended by balloons, and even very recently a gentleman, who possesses no knowledge whatever of telegraphy, has endeavored, by the powerful aid of the press and other means, to thrust upon us an apparatus which we know to be radically wrong in principle, and which has been anticipated or tried by nearly every telegraph engineer who has exercised thought on the subject.

On the other hand, those who possess scientific training, and those who have devoted their attention to remedy defects, have done great service to their profession. Mr. Fuller succeeded in replacing the defective sand batteries of twenty years ago by the ordinary sulphate battery, which still remains the form principally employed by the department. Mr. Varley, by the application of his powerful mind to the working of our wires, has brought the present state of insulation to the perfection it has now attained, and Sir Charles Wheatstone, by the constant and unremitting study of forty years, has brought out that beautiful automatic apparatus without which it would have been difficult for the Postal Telegraph Department to have transacted the enormous business, thrown upon its hands by the adoption of the uniform shilling rate and the low tariff applied to the press. The two first named telegraph engineers owe their success entirely to those principles of self-education that I wish to inculcate into you; and Faraday, a purely self-educated philosopher, has instanced Sir Charles Wheatstone and his inventions as examples of the effect of the continued application of these principles.

There is plenty of room in the working of our instruments and wires for the display of your powers of invention and improvement. Real improvements are not the result of chance; they are the effects of the continued application of those methods of thought and study which education, and particularly scientific education, impart.

Geometry and algebra are essential to the skilled telegraphist, and it is difficult for any one to comprehend the higher branches of the profession until he has mastered the elementary principles of these two branches of pure mathematics. It is the application of algebra which enables the telegraph engineer to tell the distance of a fault in a submarine cable to within half a mile, and to direct the sailor, with unerring accuracy, to the spot where he must apply his apparatus. . . . It is the differential calculus which enables the electrician to obtain the greatest possible speed of working with the least consumption of materials out of his submarine cable.

Applied mathematics or dynamics considers force and its measurement. A current of electricity is only one form of force, and all our methods of electrical measurement are based primarily on the laws of dynamics. The stability of our posts, the strains upon our wires, the submersion of our cables, are applications of the laws of dynamics. A knowledge of chemistry, magnetism, and electricity, is indispensible to the telegraphist. They are so mutually dependent that a little must be acquired of each branch of physics by studying any of those enumerated."

In conclusion, the lecturer considered how this knowledge is to be obtained by those whom he addresses. Briefly, he recommended as aids to study, attending lectures, reading of scientific and practical works on electricity, telegraphy, and kindred subjects, observation, experiment, and reflection.

Something about Pickles.

Pickles, as an article of food, are to the best stomachs only appetizing, and to the weakest positively injurious. Still people will eat pickles, and whatever our physiological friends may say, we do not doubt that things so generally craved have some use in the animal economy. When soldiers have chronic diarrhœa, our army surgeons usually allow them to eat pickles and other things that, under ordinary circumstances, would be considered fatal, and to the surprise of everybody the hopeless patients often recover. So, without discussing the dietetics of the matter, we accept pickles as a fact. To look at the matter physiologically, a pickle is a mere vegetable sponge to hold vinegar. Any vegetable tissue that is not so fibrous or tough as to be unpleasant to masticate, and which has no disagreeable flavor of its own, will answer for pickling. If the article pickled has an acceptable flavor of its own, all the better. It is the possession of this that makes the cucumber the most popular of all pickles. Vegetables which have no marked taste are made flavorous by the free use of spices. It is customary to salt pickles before putting them into the vinegar. Why do we? It is not for the purpose of flavoring them with salt, for this can be added to the vinegar. This matter of salting pickles brings us to the question of *osmose*, which we cannot find space to discuss. Briefly, when a fresh vegetable is placed in salt and water, an interchange takes place between the juices contained in the tissues of the vegetable and the brine by which it is surrounded. The natural juices pass out and the brine passes into the vegetable; the brine being denser, it, according to a well known law, passes in more slowly than the juices of the vegetable pass out, and the salted things shrivel. When salted pickles are placed in water the case is reversed, their shrivelled tissues are full of brine, much heavier than the water by which they are surrounded, the brine passes out, and the water goes in and restores the plumpness. Soaked pickles with their tissues full of water, being put into vinegar, readily become penetrated by that liquid. The question of salted pickles has nothing to do with flavor, as the finest pickles are those from which the salt is most completely soaked.

One of the most frequent questions is "How can I make pickles like those put up at the makers?" It may be answered that the pickles referred to are put up in colorless vinegar. Home made pickles should be prepared with regard to flavor rather than appearance. As a general rule, vegetables to be pickled are first put into brine, then soaked to freshen them, and then placed in vinegar, which may be spiced or not, according to taste. One point is to be noticed: when freshened pickles are put into not very strong vinegar, the water with which their tissues are filled so weakens the vinegar that the pickles are not only not sour enough to the taste, but not enough so as to keep well. It is not necessary to enumerate the things that may be pickled, as there are few fruits or vegetables that may not be so treated; pickled peaches are delicious, and pickled purslane is not to be despised—a wide range surely. Some good housekeepers have, besides the regular cucumber and other standard pickles, a jar of

MIXED OR INDIAN PICKLE.—The basis of this is usually sliced cabbage, and cauliflower broken into bits and put into brine. After these are ready, they are covered with spiced vinegar; and then such pickle materials, fruits, or vegetables as occur during the season are added from time to time, taking care that the newly added things are covered by the vinegar. At the close of the season, the vinegar is drained off, heated to the boiling point, and poured over the pickles; this is repeated two or three times, when the pickles are stored away for use, and are usually better in the second year than the first.

In the making of the spiced vinegar, probably no two will agree. As a suggestion we give two recipes. The various directions differ greatly; the chief object seems to be to get in enough spice. In looking them over, we are reminded of the toper's directions for making punch, "too much of lemons, sugar and whisky, and not enough water." One recipe gives: Vinegar, 6 pints; salt, ½ lb.; bruised ginger root and whole mustard seed, 2 oz. each; mace, 1 oz.; shallots, ½ lb.; cayenne pepper, a dessert spoonful, and some sliced horseradish. Simmer together for a few minutes, then put into a jar and cover close. Another, claimed to be "very superior," directs for each gallon of vinegar 6 cloves of garlic, 12 shallots, 2 sticks of sliced horseradish, 4 oz bruised ginger, 2 oz. whole black pepper, 1 oz. allspice, 12 cloves ¼ oz. cayenne pepper, 2 oz. mustard seed, ¼ lb. mustard (ground), and 1 oz. turmeric. All the above, except the mustard and turmeric, are put into the jar with cabbage, cauliflower, and other pickle vegetables, and the vinegar boiled and poured over them. The ground mustard and turmeric are to be made into a paste, with cold vinegar added.—*London Farmer.*

THE manufacture of ice in New Orleans has been the means of reducing the price to $8 per tun.

Manufacture of Gold Leaf.

The process of gold beating is exceedingly interesting in its various details, and is one which requires the exercise of much judgment, physical force and mechanical skill. The gold must first be properly refined. The process is as follows: The coin is first reduced in thickness by being rolled through what is known as a "mill," a machine consisting of iron rollers operated by steam power. After being rolled, it is annealed by being subjected to intense heat which softens the metal. It is next cut up and placed in jars containing nitro-muriatic acid, which dissolves the gold, and reduces it to a mass resembling Indian pudding, both in color and form. This solution is next placed in a jar with copperas, which separates the gold from the other components of the mass.

The next process is to properly alloy the now pure gold, after which it is placed in crucibles and melted, from which it is poured into iron molds called ingots, which measure ten inches in length, by one inch in breadth and thickness. When cooled, it is taken out in the shape of bars. These bars are then rolled into what are called a "ribbon," usually measuring about eight yards in length, of the thickness of ordinary paper, and retaining their original width. These "ribbons" are then cut into pieces an inch and a quarter square, and placed in what is called a "cutch," which consists of a pack of French paper leaves resembling parchment, each leaf three inches square, and the pack measuring from three quarters of an inch to an inch in thickness. They are then beaten for half an hour upon a granite block, with hammers weighing from twelve to fifteen pounds, after which they are taken out and placed in another pack of leaves called a "shoder." These leaves are four and a half inches square, and the gold in the "shoder" is beaten for four hours with hammers weighing about nine pounds. After being beaten in this manner, the gold leaves are taken out of the "shoders" and placed in what are called "molds." These "molds" consist of packs of leaves similar to the other packs, and made of the stomach of an ox. After being made ready in the "molds," the gold is beaten for four hours more with hammers weighing six or seven pounds each.

It will be noticed that the thinner the leaf becomes, the lighter are the hammers used, and it is also necessary in beating the gold, especially in striking the "mold," that the blow should be given with the full flat of the hammer and directly in the center of the "mold." Should the beater strike with the edge of the hammer, there is every chance that the leaf will be broken and the pack spoiled. The leaf, after being taken out of the "mold," is cut into squares of three and three eighths inches, and placed in "books" of common paper. Each "book" consists of twenty-five leaves, and there are twenty "books" in what is known as a "pack."

The same process is used in the manufacture of silver leaf, the only difference being that the metal, being softer, requires less time to manufacture.

Gold foil is made in a manner similar to gold leaf, except that the sheets are thick and are annealed separately, while the chief distinction is that it has, if a genuine article, no alloy whatever. The article known as "German gilt" is not made from gold at all. The wood upon which it is to be placed is first made exceedingly smooth, and then painted with a preparation which, being covered with silver leaf, has the property of producing a gold-like appearance.

The busiest season for selling leaf or foil is just approaching, and the present evidences are that the demand will be large. The summer business has been good, better, in fact, than business generally.—*Commercial Bulletin.*

Decorative Painting on Tin.

Tinfoil is spread out upon a smooth surface, such as glass the latter having been first moistened to aid the laying out of the foil and to maintain it in its position. The painting is then executed upon it in oil. This painting on tin, when dried and varnished, can be rolled up like ordinary paper hangings, from which it essentially differs in possessing all the variety of tones and coloring that oil paintings admit of. The tin groundwork constitutes a waterproof protection, and, on account of its great flexibility, will follow the various moldings and contours of the object to be ornamented. To the latter should be applied a hydrofuge mixture, when it will be ready for the decorator. This method can replace ordinary gilding, as the gold can be applied in the workshop and the gilt tin fixed afterwards. The advantage of gilt tin over gilding on other metals is that it is inimical to oxidation; whereas it is known that gilding upon other metals, and notably upon zinc, deteriorates rapidly.—*M. C. Daniel.*

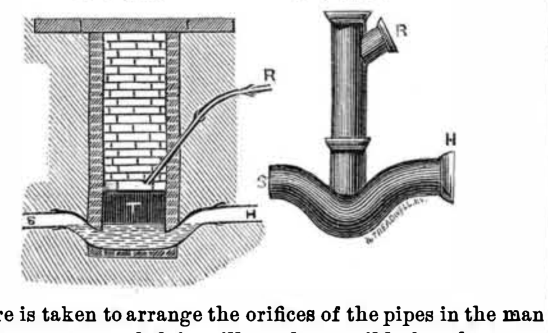
BRIDGE OVER THE NILE.—The Fives-Lille Company are reported to have completed and opened for traffic a large new bridge between Kasr-el-Nil and Gehsireh, uniting the suburbs of Cairo with the opposite or left bank of the river Nile. This bridge is of iron, double trellis girders, and constructed in two parts, one fixed and the other movable, for the service of the navigation. Its length is about 450 yards, or a little over a quarter of a mile, and the width between the centers of the girders is not quite 40 feet. The total weight of the bridge is 1,600 tuns, and it has been built within two years.

THE Belgian government some time ago appointed a commission to inquire into the sanitary relations of factories where chemicals are made. In their report, the commission places alkali works among the most noxious of all. They also condemn tall chimneys as being more hurtful than short ones, in consequence of the greater surface over which they diffuse deleterious gases and vapors, as well as for the reason that, by increasing the draft, tall chimneys discharge gases into the air, which would be otherwise absorbed in the passage.

House Drains.

Mr. Osborne Reynolds, Professor of Engineering at Owen's College, Manchester, Eng., proposes to abolish all house traps altogether, and deal with the sewer gas outside the house. He places an ordinary siphon pipe between the house and the sewer, connecting the bend in the siphon—which practically forms the trap—with the open air. He has applied the principle to his own house, as shown in the annexed section. All the drains in the house are connected with the pipe, H, Fig. 1, which leads to a siphon trough, T, at the bottom of the man hole, the latter being constructed as near the house as may be convenient. The floor of this man hole is 2 feet above the bottom of the drain, which passes through it in the shape of an open trough, T, 2 feet and the width of the pipes deep, the sides being rendered in cement. This trough is so laid that the water stands half an inch above the orifice on the sewer side, S, and an inch on the house side, H, while, to prevent scum forming on the surface, the pipe, R, brings rain water from the roof and discharges it at the upper part of the trough, T. Of course, in most cases a much simpler arrangement than this will suffice for the sanitary requirements of the house, for a siphon trap, Fig. 2, with a pipe communicating with the surface and connected with the rain water pipe, will be found to prevent all influx of gas into the house. In this way, a trap is formed which effectually closes both the house and the sewer from the man hole, and doubly closes the house from the sewer; and

FIG. 1 FIG. 2



if care is taken to arrange the orifices of the pipes in the man hole, as recommended, it will not be possible for the water to be sucked out of the trap even should the pipe run full.

Importance of Fuel Saving Appliances.

In his recent address before the Institution of Mechanical Engineers, London, President Siemens stated that the annual coal production in Great Britain amounts at present to 120 million of tuns, which, if taken at 10s. per ton of coal delivered, represents a money value of £60,000,000. It would not be difficult to prove that, in almost all the uses of fuel, whether to the production of force, to the smelting and reheating of iron, steel, copper, and other metals, or to domestic purposes, fully one half of this enormous consumption might be saved by the general adoption of improved appliances which are within the range of our actual knowledge without entering the domain of purely theoretical speculation, which latter would lead us to the expectation of accomplishing our ends with only one eighth or one tenth part of the actual expenditure, as may readily be seen from the following figures: One pound of ordinary coal developes in its combustion 12,000 units of heat, which in their turn represent 12,000×772=9,264,000 ft. lbs., or units of force, which represents a consumption of barely ¼ lb. of coal per indicated horse power per hour, whereas few engines produce the indicated horse power with less than ten times that expenditure, or say 2½ lbs. of fuel. Again, the heat required to raise a tun of iron to the welding point of say 2,800 degrees Fahrenheit requires 2,240×2,800×0·13 (specific heat of iron) = 815,360 units of heat, which are producible by 815,360 divided by 12,000=68 lbs. of coal) whereas the ordinary heating furnace consumes more than ten times that amount. In taking credit, however, for only 50 per cent of the actual average expenditure, we arrive at an annual money saving of £30,000,000 per annum—a sum equal to nearly one half the national income! Nor does this enormous amount of waste indicate all the advantages that might be realized by strict attention to appliances for saving fuel, which are, generally speaking, appliances for improving the quality of the work produced.

Soapstone Manufacture.

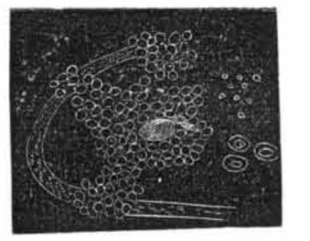
Soapstone has recently found a new application as a raw material for buttons, dominoes, and other similar objects. Chips and refuse pieces of the mineral are ground to powder, mixed with silicate of soda—water glass—and after a repose of some hours, drying on a plate, when the mixture is again pulverized. The powder is then subjected to powerful pressure in molds, and afterwards baked in airtight fireclay crucibles. The pressed objects are a second time saturated with water glass, and again heated out of contact with the air. The hardness of the products depends, in a great measure, upon the number of times the heating is repeated. The last stage of the process of manufacture consists in washing in water in a rotary tub, drying and agitating in a suitable vessel with soapstone powder, which imparts a polish to the surface.

THERE is something more than a daily ferry now between Europe and America. In fact, the rate is something like a steamer for every 12 hours from the port of Liverpool alone. During the month of May, 53 steamships left the Mersey, of which 17 belong to the Cunard company, 11 to the Inman, 5 to the National, 5 to the White Star, 10 to the Allan, and 6 to the Guion Company, respectively. When to these are added the ships of the French and the German lines, we get some idea of the prodigious increase of late in steam communication between the continents.

DETECTION OF IMPURITIES IN MILK.

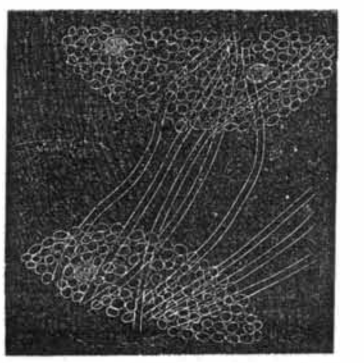
A recent number of the *Lens* contains an interesting report by Professor James Law, of Cornell University, upon certain microscopic examinations, by him made, of some samples of suspected milk. The latter was supplied by one of the best farmers near Ithaca, N. Y., and the author took the usual precautions to prevent the access of foreign matter after the receipt of the liquid for examination. This milk, when delivered, looked rich and good, presenting nothing unusual in color, consistency or flavor. But after standing for twelve hours, it had become viscid, and fell in fine threads from the point of a needle dipped therein. Placed under the microscope, it showed an abnormal adhesiveness of the oil globules, which had accumulated in dense masses instead of remaining apart as in healthy milk. Intermixed with the globules were dark colored spherical bodies of a much larger size (spores) and filaments. This cryptogam, or species of plant, steadily grew, and at the end of forty-eight hours presented the form shown in Fig. 1.

FIG. 1.



The farm buildings, pastures, and water supplies, where the cows were kept, were then examined and found to be in excellent order. The water drunk by the cows issued from a couple of springs, and, to the naked eye, looked perfectly clean and pure. But, under the microscope, it was found to contain numerous diatoms and spores of some low form of vegetable life. A little of this water was placed in a portion of milk which, by previous examination, had been found to be pure. In three days the milk so treated had become viscid, and contained numerous spores and mycelium (as shown in Fig. 2) which continued to grow.

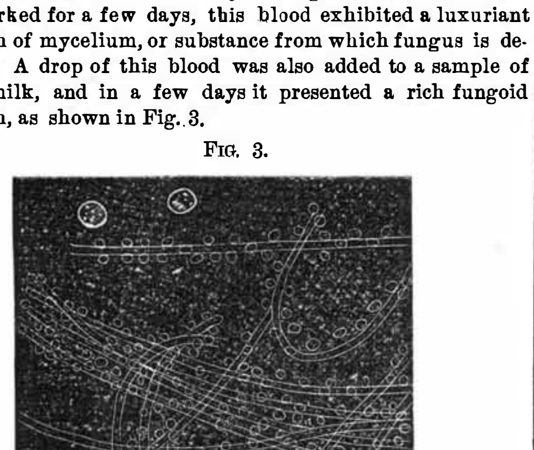
FIG. 2.



Two cows, from which the impure milk first mentioned was obtained, were then examined. The animals appeared to be in good health in every respect; but on application of the clinical thermometer, it showed a temperature of 102°, while the temperature of the other cows, giving pure milk, indicated only 100°.

A little blood was then drawn from the affected cows, and, by aid of the microscope, was found to contain ovoid bodies, double the size of the ordinary blood globules. After standing corked for a few days, this blood exhibited a luxuriant growth of mycelium, or substance from which fungus is derived. A drop of this blood was also added to a sample of pure milk, and in a few days it presented a rich fungoid growth, as shown in Fig. 3.

FIG. 3.



The farm springs were now fenced, and the cows supplied with water from another source—a well upon the premises. Dram doses of the bisulphite of soda were given, for one week, to all the stock. The impurities of the milk at once disappeared, and have not returned.

The chain of evidence now appeared complete. The water contained vegetable spores, which developed into a luxuriant growth of mycelium, when allowed to stand or when added to milk of known purity. The presence of similar germs in the blood was demonstrated by microscopical examination, by the further development of the cryptogam when the blood was allowed to stand, and by the appearance of the same product in milk to which a drop of this blood had been added. The constitutional effect of its presence was slight, being manifested by a rise of temperature not exceeding 2° Fah. The germs in question were present in the milk, and grew with great rapidity in this medium. Lastly, the disuse of the contaminated water and the administration of sulphites put an end to the affection.

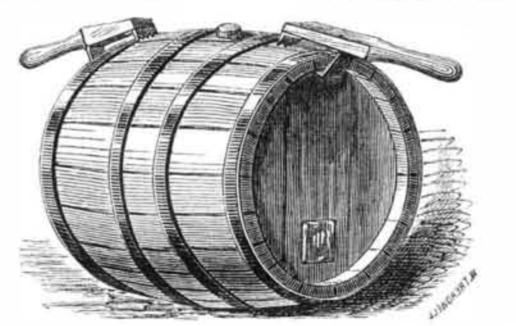
There is one more feature of the case which ought not to be passed without notice. Out of a herd of about twenty cows, only one or two were attacked at first, and after giving tainted milk for a week or more they recovered, while one, two, or three more had in the meanwhile been taken ill. At first the whole of the milk was injured by the admixture of the impure, and it was only by setting aside a little milk from each cow in a separate vessel that the owner was enabled to fix on the affected ones.

This unsusceptibility of the majority of the cows to the agent which all alike were swallowing, and the acquirement of this susceptibility by one after another at irregular intervals, demand investigation.

It may be added that Dr. Percy's report to the New York Academy of Medicine, in 1858, "On Swill Milk," shows the presence of spores in such milk when drawn and the growth of mycelium within twenty-four hours thereafter, though the liquid had stood in a well corked bottle in the interval. This report shows, further, the tendency of such milk to induce severe and even fatal disorders of the digestive organs of infants fed upon it exclusively in its fresh condition.

HANDLES FOR BARRELS AND BOXES.

This is the invention of M. S. Scofield, of Stamford



Conn. The construction and manner of using these handles can be readily understood from the engraving. To adapt them for use on boxes or other packages without chimes, the jaws are serrated or toothed, so that, by a sudden thrust of the handle, the teeth of the hook-shaped jaw will be forced into the side of the box sufficiently to give the handle a firm hold upon it. This seems a simple, useful, and practical invention.

Progress of the Telegraph.

The progress of the electric telegraph within the past six years has been very great in every quarter of the globe. Upon this continent, the electric wire extends from the Gulf of St. Lawrence to the Gulf of Mexico, and from the Atlantic to the Pacific Ocean. Three cables span the Atlantic Ocean, connecting America with Europe, and another submerged in the Gulf Stream unites us with the Queen of the Antilles. Unbroken telegraphic communication exists between all places in America and all parts of Europe; with Tripoli and Algiers in Africa, Cairo in Egypt, Teheran in Persia, Jerusalem in Syria, Bagdad and Nineveh in Asiatic Turkey, Bombay, Calcutta, and other important cities in India, with Hong Kong and Shanghai in China, Irkoutsk, the capital of Eastern Siberia, Kiakhta on the borders of China, Nagasaki in Japan.

A direct line of telegraph, under one control and management, has recently been established between London and India, with extensions to Singapore, Hong Kong, Java and Australia.

Europe possesses 450,000 miles of telegraphic wire and 13,000 stations; America, 180,000 miles of wire and 6,000 stations; India, 14,000 miles of wire and 200 stations; and Australia, 10,000 miles of wire and 270 stations; and the extension throughout the world is now at the rate of 100,000 miles of wire per annum. There are, in addition, 30,000 miles of submarine telegraph wire now in successful operation, extending beneath the Atlantic and German oceans; the Baltic, North, Mediterranean, Red, Arabian, Japan and China seas; the Persian Gulf; the Bay of Biscay, the Strait of Gibraltar, and the Gulfs of Mexico and St. Lawrence.

More than twenty thousand cities and villages are now linked in one continuous chain of telegraphic stations. The mysterious wire, with its subtle and invisible influence, traverses all civilized lands, and passes beneath oceans, seas and rivers, bearing messages of business, friendship and love, and constantly, silently but powerfully, contributing to the peace, happiness and prosperity of all mankind.

RE-SENSITIZED PHOTOGRAPHIC PLATES.—After the collodionized plate has been sensitized in the nitrate bath in the usual manner, it is exposed to a weak diffused light; the picture is then taken in the ordinary way. Singular as it may appear, this exposure to diffused light increases the sensitiveness of the plate for pictorial purposes. Anthony's *Photographic Bulletin* states that Mr. H. J. Newton, of this city, has fully tried the plan, and finds that it reduces the time of exposure nearly two thirds without any photographic loss. Mr. Gutzlaff, of Bahia, Brazil, is the patentee of this new method.

M. GAUDUIN has been making experiments to supersede borax, which is generally employed in soldering, and the result is that he finds that an excellent flux for soldering iron, and brazing copper and aluminium bronze, is obtained by a mixture of equal parts of cryolite and chloride of barium. Cryolite is a product and export of Greenland, and consists of a double fluoride of aluminium and sodium.