Science and Practical Arts.

TELEGRAPHS—ELECTRO-MAGNETIC TELEGRAPH.

Though the telegraph has been known and used by the moderns not more than half a century, it is not altogether a modern invention. From the earliest times men have known how to communicate with each other at a distance. Some sort of telegraph seems to have been in use amongst the ancient Greeks. It is said that the burning of Troy was known in Greece before any messenger could have conveyed the intelligence. Such communications, however, were confined to occasions of emergency—such as battles and civil commotions—and were made by means of fire signals. POLYBIUS speaks of the instruments employed by the ancients for telegraphic communications, and mentions improvements in them suggested by himself. But the language of torches was very limited and imperfect; and the beacon flames which arose from hill to hill over a whole landscape, could announce nothing more than the occurrence of some remarkable event—could give no definite information respecting it. Both in England, France, and Spain, during the seventeenth and eighteenth centuries, improvements were made in this mode of communication by the erection of poles or masts at convenient distances on the most elevated hills between different places, and the invention of an apparatus of characters consisting of moveable arms, the different positions of which stood as signs of words or letters of the alphabet, and were moved in all directions by a piece of mechanism contrived for that purpose. The first application of this kind of telegraph to practical purposes was in France in 1793. The first telegraph post was made by M. CHAPPE from Paris to Lille, a distance of 130 miles, and consisted of *twelve* telegraphs or stations. The conquest of Quesnoy (a fortified town near Lille) in 1794 was by this means communicated to Paris in an hour's time. A rapidity of communication wonderful at the time, but slow indeed in comparison of the speed with which news is transmitted by the electrical telegraph! The night telegraphic communications were made by illuminating the apparatus, or by a preconcerted disposition of lights. The British Admiralty has long made much use of this kind of telegraphs; and under its auspices several important improvements in them have been effected. But it is apparent how comparatively slow is this mode of communication; how often the state of the atmosphere must interrupt its operation; and how easily a blunder at any one of the many stations might occasion mistake.

Of quite a different character is the electro-magnetic telegraph, of which we propose to say a few words. The electric fluid travels one-third faster than the light itself; the speed of light being 192,000 miles in a second, while that of the electric fluid is 288,000 miles; thus in a single second of time travelling a distance of more than eleven times the circumference of our globe! This subtle, invisible fluid, the essence of which is entirely unknown to us, has been pressed into the service of man by the discovery and invention of modern science and art, and made the messenger of thought and affection from city to city and country to country with more than the swiftness of the solar rays. Here is incomprehensible mystery and indisputable fact inseparably conjoined. The former discredits the latter no more than the latter explains the former. Yet such an union scepticism has presumed to pronounce unphilosophical and irrational in a Book and System which treat not of the mechanical properties and powers of nature, but of the attributes and government of Nature's Architect and Ruler!

In the brief explanations to which these pages limit us, we will remark upon some peculiarities of the fluid itself, and then upon the means by which it is generated and applied in the operations of the electrical telegraph.

Electricity is a term employed to describe the operations of a subtle elastic fluid which pervades the whole material world. The nature of this fluid is entirely unknown to us. It is only seen in its phenomena or effects—such as attraction and repulsion, heat and light, mechaninal violence and shocks to the animal system. The term electricity is often applied to designate the fluid itself, as well as the science which unfolds its laws and phenomena. This fluid is readily communicated from one substance to another; but some substances are much better conductors of it than others. Metals are the best conductors of it; glass is one of the several non-conductors of it; that is the glass will not pass off the fluid from one substance to another. This is the reason why glass cups or tubes are placed upon the tops of the telegraphic poles for the wire to pass through in order to *insulate* the wire from the earth—the great reservoir of electricity. Earthenware cups or tubes are sometimes used—answering the same purpose as glass. Did the wire come into contact with any one supporting pole, the electric fluid would pass to the ground, and the electrical communication between two telegraphic stations would be interrupted. It is essential that the telegraphic wire throughout its whole length, (except at the two ends,) be completely *insulated* from the earth. Iron and copper being good conductors of electricity, explains the reason why wire made of one or the other is used as the line or channel of telegraphic communication. When iron wire is used (as has always been the case in England), it has usually been coated with zinc by a particular process, and thus received the name of galvanized iron wire. When copper wire is used (as was the case in the first telegraphs in the United States), it is covered with cotton thread, saturated with shellac, and then again, with a composition of asphaltum, beeswax, resin, and linseed oil. The copper wire weighed from 80 to 100 pounds per mile. It is now universally displaced by iron wire of a weight of 300 to 330 pounds per mile. This is single, or twisted, unprotected or galvanized. The advantages of the protecting coat are said to be counterbalanced by the loss of pliability and toughness; and good iron having stood the test of years, the naked wire is generally used. This is the wire used for the Canadian telegraphs. Its cost of this kind of wire in the United States is from 6 to 10 cents per pound.

But to return to the electrical fluid. This wonderful agent is excited either mechanically or chemically; and derives its name from the manner in which it is generated. When excited by *friction*, it is called *Machine* or *Frictional Electricity;* when excited by *heat*, it is called *Thermo-Electricity;* when excited by *magnetism*, it is called *Magneto-Electricity;* and when excited by *chemical* action, it is called *Galvanic* or *Voltaic Electricity* (or Galvanism), from its discoverers. This is the kind of electricity employed in the electrical telegraph. Dr. FARADAY, in a paper published a few years since, has ably maintained the identity of the different kinds of electricity,—their phenomena differing merely in the state and degree of intensity in the action of the fluid. Some of the peculiar phenomena of *galvanic electricity* are the power of producing an *electro-magnet*, which atmospheric or machine electricity has no power of producing for practical purposes; the flow of a continuous current, like a living stream, while machine electricity is sudden in the discharge and exhaustion of its power, like the explosion of a mine or the discharge of a cannon; the density which requires and is easily confined to a *continuous* conductor, while common electricity prefers dissipation in the atmosphere to