GUTTA-PERCHA INSULATION.

CHAPTER XXXVIII.

Application of Gutta-Percha as an Insulation—Discovery of Gutta-Percha, its Nature, Qualities, and Chemical Properties.

APPLICATION OF GUTTA-PERCHA AS AN INSULATION.

All efforts to insulate telegraph wires for submarine and subterranean lines proved ineffective until the introduction of gutta-percha, a substance of peculiar growth as hereinafter described. I do not propose to determine when it was first applied to telegraphing. In the year 1847 a manufactory of gutta-percha for the insulation of telegraph wires was established in Brooklyn, New-York, by Mr. Samuel T. Armstrong, who had ascertained that the substance was a non-conductor of electricity. Immediately following this scientific fact, machinery was made for the application of gutta-percha to telegraph wires, and a trial of the same was made across the Hudson river in 1848. It was eminently successful, and at the time Mr. Armstrong was so sanguine of the perfection of the insulation, that he published, in the New-York Journal of Commerce in 1848, a proposition to insulate and lay a telegraph cable across the Atlantic Ocean for the sum of $3,500,000.

Since that time sub-aqueous conductors have been very greatly improved, and minds of great power are still at work for the perfection of submarine telegraphy.

The manufacture of gutta-percha as an insulation was commenced in England about the same time as it was in America, and the establishment in London, under the direction of Messrs. Statham & Co., has done wonders in the progress of the art. They have from the beginning exhibited a degree of enterprise not surpassed by any others in the art of telegraphing. To London and New-York manufactories the telegraphic world is greatly indebted for the degree of perfection now enjoyed in the use of gutta-percha.

Other establishments for the manufacture of gutta percha have been conducted at Berlin, Prussia, and at St. Petersburg, Russia, but the two most prominent are those of Messrs. Statham & Co., in London, and Mr. Samuel C. Bishop of New-York. It is peculiarly fortunate that the telegraph enterprise has as promoters gentlemen of such sterling worth.

[Leaf and Fruit of the Gutta-Percha Tree.]

GUTTA-PERCHA, ITS DISCOVERY, QUALITIES, CHEMICAL PROPERTIES.

Gutta-percha—the Malayan term given to a concrete juice taken from the Isonandra gutta tree—is indigenous to all the islands of the Indian Archipelago, and especially to the Malayan peninsula, Borneo, Ceylon, and their neighborhoods, where are found immense forests of the tree, yielding this product in great abundance. Its fruit contains a concrete edible oil, which is used by the natives with their food. The gutta (or juice) circulates between the bark and the wood of the tree, in veins whose course is distinctly marked by black longitudinal lines. The natives were originally in the habit of felling the tree when they required a supply, but have been taught by experience that the juice can be obtained by cutting notches at intervals in the trunk, and save the life of the tree for future tappings, as our maples for successive years yield their sap to the sugar manufacturers. The juice consolidates in a few minutes after it is collected, when it is formed by hand into compact oblong masses of from seven to twelve or eighteen inches in length by four to six inches in thickness, and these, when properly dried, are what is known as the gutta-percha of commerce.

It is but a few years since the knowledge of the existence of this ductile secretion dawned upon the world. Dr. Montgomerie, an assistant surgeon at Singapore, observed in the possession of a native the handle of a wood-chopper of such singular material that it awakened his attention, and on inquiry and examination he found it to have been made of the juice of this strange tree—becoming plastic when dipped in hot water, and when cold regaining its original stiffness and rigidity. Within this brief period the exudations of these dense forests have assumed, in America and England, innumerable forms. It is singular indeed that there should circulate in the veins of the primeval forests of Malacca and the neighboring isles, a sap or juice so long a stranger to the civilized world, possessing such extraordinary virtues, and, in so short a period of time, entering so largely and variously into the service of man, and destined to become his servant in a greater variety of forms than any other material yet discovered.

The gutta-percha of commerce is of a light brown color, exhibiting a fibrous appearance, much like the inner coating of white oak bark, and is without elasticity. When purified of its woody and earthy substance, it becomes hard like horn, and is extremely tenacious, indeed its tenacity is wonderful.

Mr. Burstall, of Birmingham, referring to some experiments testing the strength of tubes composed of this material, says:

"The tubes were three fourths inch bore, the material one eighth thick. They were tested by the Water Company's proving pump, with its regular load of 250 pounds to the square inch; afterward we added weight up to 337 pounds, and I wished to have gone to 500 but the lever of the valve would bear no more weight; we were unable to burst the pipe." Another gentleman, Mr. Andrew Robertson, of Stirling, says: "I am of opinion that no other material is so well fitted for the above purposes" (extinguishing fires and watering the streets in dry weather) "as gutta-percha; for, although our pressure is perhaps the greatest in the kingdom, being upward of 450 feet, not the slightest effect could be discovered on the tube or joints, while the same pressure on our leather hose sends the rivets in all directions."

The application of heat to this crude material makes it soft and plastic, and in a temperature of about 200 degrees it becomes quite ductile, when it is capable of being moulded into any desired shape, which it will retain when cool. It can be dissolved by sulphuret of carbon, or chloroform, or if immersed for a time in spirits of turpentine. It is repellant of and completely unaffected by cold water, but is softened and made adhesive by warm water. It is a *a non-conductor of heat* and electricity; is proof against alkalies and acids, being only affected by the sulphuric or nitric in a highly concentrated state; while the most powerful acetic, hydrofluoric or muriatic acids or chlorine have no perceptible effect upon its structure or capabilities. This gum has qualities entirely differing from the India-rubber. It cannot be worn out. It can be melted and remelted, and repeatedly remoulded without changing its properties for manufacture or losing its virtue. It is lighter than rubber, of finer grain, and possesses certain repellant properties unknown to that material, and is extremely tough. It disregards frost and displays remarkable acoustic qualities.

In its crude state gutta-percha has no resemblance whatever to India-rubber in appearance, nor are its chemical or mechanical properties the same, nor does the tree from which it is taken belong to the same botanical family, or grow in the same latitudes or soil; yet, from the fact that it could be dissolved and wrought into water-proof wares, many have inclined to the belief that the two materials are identically or nearly the same.

Gutta-percha when immersed in boiling water, contracts in bulk.

India-rubber when immersed in boiling water, expands and increases in bulk.

Gutta-percha juice is of a dark brown color, and consolidates in a few minutes after exuding from the tree, when it becomes about as hard as wood.

India-rubber sap is perfectly white, and of about the consistency of thick cream; when it coagulates it gives from four to six parts water out of ten; it may be kept like milk, and is frequently drank by the natives.

Gutta-percha first treated with water, alcohol and ether, and then dissolved in spirits of turpentine and precipitated, yields a substance *consistent with the common properties* of gutta-percha.

India-rubber similarly treated results in a substance resembling in appearance gum-arabic.

Gutta-percha by distillation yields fifty-seven and two thirds per cent. of volatile matter.

India-rubber by the same process yields eighty-five and three fourths per cent.

Gutta-percha in its crude state, or in combination with other materials, may be heated and reheated to the consistency of thin paste, without injury to its future manufacture.

India-rubber, if but once treated in the same manner, will be destroyed and unfit for future use.

Gutta-percha is not decomposed by fatty substances; one application of it is for oil vessels.

India-rubber is soon decomposed by coming in contact with fatty substances.

Gutta-percha is a non-conductor of cold, heat, and electricity, and in its natural state is non-elastic, and with little or no flexibility.

India-rubber is a conductor of heat, cold, and electricity, highly elastic and flexible.

The specific gravity of gutta-percha is much less than that of India-rubber, in proportion as one hundred of gutta-percha is to one hundred and fifty of India-rubber.

Chemists who have analyzed them vary a little as to their chemical proportions, but all agree that the chemical properties and mechanical action of gutta-percha and India-rubber are so entirely distinct and dissimilar, that they should never be classed under the same head, chemically or mechanically any more than commercially.

M. Arppe, a celebrated German chemist, says gutta-percha differs in composition from caoutchouc, and that the products of dry distillation of gutta-percha are different from those of caoutchouc. He considers gutta-percha to be a mixture of six resins, which have been formed from a carb-hydrogen.