[For the Scientific American].

PORTLAND CEMENT.

BY DR. ADOLPH OTT.

Portland cements are those artificial hydraulic mortars which are burned so that vitrification has partially taken place, and which, in this condition, contain no free lime and have a specific gravity above 3. The name originated with Joseph Aspdin in Leeds (England), in 1824. The solidified cement, having an appearance and quality equal to those of Portland stone, of which the finest edifices of the English metropolis are built, he gave to his product the name of Portland cement. When we learn that this stone is classed among the most valued building materials of England, the said designation might be considered too assuming, but it will be shown that its qualities are not overrated—in fact, that the name must be considered as very appropriate.

The Portland cement presents itself as a sharp, crystalline powder, of a color varying from light to dark gray and of a bluish or greenish tint. Chemically, it is essentially a combination of lime, silica, alumina, and oxide of iron. When mixed with water to a stiff paste, it soon solidifies into a stone of an agreeable bright gray stone color, which in its best quality attains a hardness and power of resistance equal to that of the most valued limestones, even of those of the oldest formations. Such stone, according to Major-General Gillmore, acquires during the first two years fully nine tenths of the strength and hardness which it finally attains in the course of time. Both the tensile and crushing strength vary, of course, according to the quality of the cement; but they are generally the greater the denser the mortar. The tensile strength per square inch of blocks seven days old was found by Mr. Grant to be 236 pounds for English cement powder weighing 103 pounds per U. S. bushel, while it was 406 pounds for cement weighing 126 pounds, thus showing a difference of 170 pounds per square inch. The strength of Boulogne cement for blocks, fifteen months old, was found to be by Gillmore 496 pounds. At the age of one month, according to this authority, the tensile strength of pure Portland cement is equal to about two thirds of what it attains during the first two years. With regard to the crushing strength of the cement, it does not reach its maximum limit within a period of two or perhaps three years. The crushing weight of English Portland cement was found by Grant to be, per square inch, 3,806 pounds for blocks three months old, 5,388 pounds at the age of six months, and 5,973 pounds at the age of nine months.

Cement unmixed with other material finds but a very limited application, firstly because it would be too expensive, and secondly for the fact because, though mixed with inert materials, it is yet sufficiently strong for most practical purposes. Portland cement, with three times its quantity of sand, becomes in a few months superior to mortar more than a hundred years old, while the cost of the material is reduced in no small degree.

For foundations, flooring, houses, constructions in the sea, etc., chips or small stones, gravel, broken bricks, burned clay, cinders, etc., are generally used in combination with sand. Such a mixture is then termed *béton* or concrete (from *concreresco*). The substitution of common lime for a portion of the cement results always in a sacrifice of strength in proportion to the extent of the adulteration; however, when mixed with a small quantity of lime milk, it loses proportionately but little of its solidity, while it can be worked much better and surer, as the setting is greatly retarded by such an admixture.

With regard to the durability and healthfulness of constructions of Portland cement, European experience, extending over a period of more than forty years, has established the fact that they will resist climatic influences and changes equally well as the very best building stones. Portland cement stone, if properly made, is almost impervious to water, while this cannot be said of brick and sandstone. Since warmth and moisture are peculiarly favorable to vegetable growth, these building materials are more liable to disintegration than other materials with less absorptive power. The resistance to frost is absolute, even in those buildings the roofs of which are terraced in this material. Being non-absorbent of moisture, it will not appear strange that houses built with it are from eight to ten degrees warmer in winter than houses built of brick.

Concerning the cost, 100 cubic feet of superior wall can be built, according to close estimation, for \$17. This is considerably less than half the cost of construction of brick and mortar. Lintels, sills, caps, and arches can all be made at the same time and with only a slight increase of expense. The partition walls need not be eight, but four, at most five, inches being required.

By the addition of proper colors, the brown stone of New York city is imitated so accurately in Portland cement stone that the eye can scarcely detect the difference. With regard to the proportion in cost of these two stones, it may be stated that the price list of one of the companies in this city shows that the rates for ashlar, caps, corner blocks, keys, etc., range from one half to one third those usually paid in this market for blocks of cut brown stone of corresponding shapes.

For such stone, as well as for ornamental work, only fine washed sand is used as admixture for the cement.

The cost of artificial stone being so much smaller for plain work, it is evident that the difference must be much greater for ornamental work, for the cost of producing the most elaborate designs, the molds being once made, is but little more than that of the simplest blocks. When we consider that in the ornamentation of our public and private edifices there is no limit except that of design, and that duplicates of

celebrated statuary can be furnished with ease, the invention of Portland cement is to sculpture and architecture what photography is to the arts of drawing and painting.

HUMAN HAIR AND ITS SUBSTITUTES.

Formerly, as ladies grew in years and their hair became thin, a false "switch" was procured, and combined with the growing hair to repair the ravages of time. Great care was taken to conceal the fact that false hair was worn, and it was only to her most intimate lady friends that the fact was whispered even.

But now all this is changed. Nineteen twentieths of all the women in the country who make any pretense to dress wear false hair or some artificial equivalent, and the lady who, no matter how luxuriant her tresses, should presume to appear in society without supplementing their natural growth with "rats," "mice," "switches," "bands," or some other specimen of the wigmaker's handiwork, would find herself so hopelessly in the minority and so laughed at by all, from her dressing maid to her most intimate friend, that resistance would be impossible, and surrender at discretion imperative.

WHERE THE HAIR COMES FROM.

The hair which adorns the heads of our belles and matrons comes mainly from the heads of the peasant women of France, Germany, and Italy. The hair buyer, supplied with sundry stores best calculated to captivate the rural eye, travels from village to village, seeking out those whose wealth of hair gives promise of a handsome price in the Paris market, the great center of the hair trade, and drives the best bargain he can in obtaining it. Sometimes the price is paid in money, but more generally in finery of various kinds, such as ribbons, cheap laces, trinkets, etc., a trade in which the buyer realizes a handsome profit both ways, and the seller parts with the adornment which Nature has provided for almost worthless ornaments which she will soon tire of and throw aside.

Having completed his purchases, the buyer takes or sends the hair he has collected to the broker, who buys it at a price which pays the buyer well for his trouble. It next goes into the hands of the merchant, under whose supervision it is cleaned with meal, sorted as to length and color, and put up in packages weighing from one to four ounces, each consisting of hairs of uniform length and color, but not all the product of any one head.

HOW HAIR IS RUINED.

Strange as it may seem, the hair which grows upon the heads of our fashionable ladies has no commercial value. Through much crimping, curling, and dosing with various hair "invigorators," "restorers," pomades, etc., it not only becomes variegated in color, but hard and brittle, rendering it wholly unfit for use in the manufacture of hair work. Indeed, it is found that the more people "take care" of their hair, the more they injure it, while those European peasants who let Nature take its course, and seldom even comb their hair, produce the finest and most delicate article.

ITS VALUE.

In the shape in which the buyer brings it in from the country, this hair is worth about \$20 per pound, in gold. After it has been sorted, the different lots vary in value according to length and shade, from \$1.50 to \$100 per ounce. Indeed, it is almost impossible to set a limit to the outside price of choice lots of long hair of desirable shades, for so difficult are they to obtain, and so urgent is the demand from parties with whom money is a secondary consideration altogether, that the fortunate holders can set their own price and be sure of a customer. "A switch of very light gray hair," said a dealer, "thirty-six inches long and weighing five ounces, is worth \$1,000, and can rarely be found at that price."

SUBSTITUTES.

In a country like ours, where fashion is a law to the poor as well as to the rich, it has been necessary to provide some cheap substitute for human hair, in order that factory and shop girls, and others of slender means, may vie with their wealthier sisters in the adornment (?) of their heads.

For this purpose, several substances are in use. The first material applied to this purpose was jute, which, after passing through several processes, is reduced to a long and glossy fiber which, in general effect, closely resembles hair, and which, owing to its comparative cheapness, rapidly came into general use. By means of dyeing, it was produced in all possible shades, and was eagerly bought in the shape of "switches," "waterfalls," etc.

ITS INJURY TO THE SKIN.

In the process of adapting jute to this use, *nicotin*, the essential principle of tobacco, and corrosive sublimate, a most deadly mercurial poison, are used. It is also rendered exceedingly brittle, and breaks as easily as spun glass. The small particles find their way through the hair to the scalp, and, their edges being ragged from the combing process, act like so many poisoned barbs, which, entering the pores and being held in place, introduce the poison beneath the skin and cause irritation and ulceration. It is owing to this that the idea became current that the jute contained animal parasites that bored into the skin and laid their eggs beneath it. The most careful examination has failed to discover any vestiges of animal life in jute, but the little barbs we have spoken of have been distinctly seen protruding from the pores of the scalp, and the sores they produce give every evidence of being the result of mercurial poison.

LINEN AND COTTON.

A more recent and harmless substitute for human hair is found in fine cotton and linen thread, dyed to the proper

shade and sized to give it the requisite gloss, and then made up into the various forms in which it can be used. Switches of this material are sold at retail for about one dollar each, a price at which a very handsome profit is probably realized by the dealer.

SILK AS A SUBSTITUTE.

Probably the best substitute for human hair yet introduced is silk fiber. Its fineness and strength render it peculiarly suitable, while its brilliant luster adds to its resemblance to the real article. It is used both alone and in connection with real hair, especially in those cases where a switch just sprinkled with gray is required. To produce this effect, dark hair and gray silk fiber are taken in unequal proportions, varying according to the shade desired, and woven together, the result being with difficulty distinguished from a combination of real hair, yet costing, owing to the immense price of long gray hair, a moderate sum comparatively. Bands and braids are also made of silk, the exposed portion only being of this material, and the filling of jute or "combing."

THE EXTENT OF THE TRADE.

Formerly hair work was sold only in a few of the leading hair dressing establishments. Now large and expensive stores are devoted to its sale in the large cities, nearly every dealer in fancy articles keeps some of the grades of so called "hair goods," and in every country store neat card board boxes, containing switches, *chignons*, and other head gear, are offered for sale. So long as fashion holds its present course, every woman in the land nearly is a customer, and thus an enormous bulk of business is done, paying handsome profits to all engaged in it. At first the percentage of profit was extremely large, but competition has reduced this materially. But the volume of business has increased in a like ratio, and the sale of hair and hair work continues to be exceedingly profitable.—*Commercial Bulletin*.

Perkins' Steam Gun.

It is now more than thirty-five years since Jacob Perkins, an American, exhibited his steam gun in London, where it attracted great attention. It was shown in operation at the Adelaide Gallery, and the inventor, writing home at the time, thus describes its working, together with a curious electrical phenomenon that took place on one occasion:

"The Adelaide Gallery, of which you have frequently heard, continues to attract attention. When I first proposed the establishment of such an exhibition as that which is made there, its success was a subject of much doubt. It is now, however, firmly established. Its average number of visitants is 300 per day, each paying one shilling for admittance; on some occasions there have been 1,000; and the visitors are of the most respectable class. My steam gun shows its balls every hour from 12 to 4 o'clock. The gallery opposite to this gun is 150 feet long, and it is frequently filled, three or four deep, with intelligent spectators; and although it has been thus in use for three years, it still continues to be the lion of the day. Foreigners who visit the gallery not unfrequently avow that the object of their journey from the continent was to see this gun. On a recent occasion, just before the last volley was discharged, the atmosphere became suddenly very dark, and many were waiting to see the last shower of balls; the steam was somewhat higher than common, the gun had been recently lengthened, and from the concurrence of these circumstances the velocity of the balls was much increased, and a very remarkable effect was produced. When the balls came into contact with the cast iron target, a very brilliant group of stars was seen on the plate, each about the size of a marigold, and somewhat resembling it in appearance; light was seen also at the mouth of the gun, and the leaden balls were completely pulverized. What could have produced these effects? Was it not the result of the development of electricity by the friction, or from some uninvestigated cause?"

A Lost Art—Glass Cloth.

More than thirty years ago, M. Bonnel, of Lille, France, discovered a method of weaving cloth, out of spun glass threads, which was described as perfectly flexible and applicable to a variety of purposes, more especially the ornamentation of the walls of apartments. This fabric, the making of which seems to be at present a lost art, was described in the papers of 1837 as follows:

This cloth of glass is extremely beautiful; and, from the manner in which it reflects the light, it surpasses in brilliancy everything that has ever been attempted with silk, even when combined with gold and silver. Some specimens of this new manufacture have been exhibited in the Passage de l'Opera in Paris; and the Queen of the French was so much pleased with them, that she ordered a golden medal to be sent to the inventor. The following passage is extracted from a French paper: "When we figure to ourselves an apartment decorated with cloth of glass and resplendent with lights, we must be convinced that it will equal in brilliancy all that it is possible for the imagination to conceive; it will realize, in a word, the wonders of the enchanted palaces of the Arabian tales. The lights flashing from the polished surface of the glass, to which any color or shade may be given, will make the room have the appearance of an apartment of pearls, mother-of-pearl, or diamonds, or composed of garnets, sapphires, topazes, rubies, emeralds, amethysts, etc., or, in short, of all these precious stones united and combined in a thousand ways, and formed into stars, rosettes, bouquets, garlands, festoons, and graceful undulations, varied almost to infinity."

STUDY contentment. In these days of inordinate greed and self-indulgence, keep down the accursed spirit of grasping.