THE CHARACTER OF GOOD LIME MORTAR.

I.—*Its Constituents.* These, it is well known, are sand and lime. A word should be said upon each.

1st. Sand, as generally found, is silex—in other words, finely broken flint stone. It is found in beds, where it has been deposited by natural causes. Silex is one of the hardest and most indestructible of minerals. The sand of some beds appears under the microscope, very smooth, as though the particles had been recently rolled about in water. In other beds it is rough and angular. This last is the best for mortar, and is called *sharp* sand. The cleaner sand is the better, since clay or muck mixed with it unfits it to combine closely with lime. Its sharpness moreover enables it to adhere to the lime more firmly.

2d. Lime. Solid limestone rock makes a very durable material for building. But if we use blocks of it, or of rough stone or brick, we need something to cement the separate pieces together, so as to give firmness and beauty to the work. For this purpose we use lime and sand mortar more commonly than anything else. Pulverized limestone would not do this. We, therefore, burn the lime; this drives off the carbonic acid, which had before constituted the particles of lime into a solid rock. Adding water to freshly burnt lime, in the proportion of about one part of water to three of lime, slakes it, so that it falls into a fine powder, called hydrate of lime. This hydrate of lime very readily absorbs corbonic acid, and returns to a condition resembling pulverized limestone, when it is entirely unfit for mortar. Lime should therefore be used soon after being slaked.

II.—*The Preparation of Mortar.*

1st. Sharp, clear sand and fresh burnt lime being at hand, the first question is the proportion of each.

2d. The principle here involved is that no more lime should be used than is just sufficient to cement the single particles of sand into a solid mass. Mortar which is thus proportioned will grow hard quicker, and cause brick or stone work to stand firmer than that which has a larger proportion of lime.

3d. The reason is obvious. Mortar (beyond its mere drying in the air) hardens by the re-absorption of carbonic acid into the solid mass, where it gradually reaches each particle of lime, converting it into limestone. Well-made mortar, properly hardened by lime, thus becomes a sort of silicated limestone. The mortar as it dries rapidly, becomes porous, to the extent that it was once filled with water. The gradual absorption of carbonic acid by the lime, fills up these pores, constituting the whole into a sort of stone, as already observed. A native of Prussia once informed the writer that some fortress, built by the Knights of St. John, at the city of Thorn, presents this singular spectacle The bricks of which they are built have gradually disintegrated, especially at the corners, leaving the mortar like a honey-comb of rock, and so firm that persons are able to climb up by the insertion of the fingers and toes in the interstices once occupied by the bricks.

Poor mortar, as the masons sometimes call it, thus makes the firmest work, if the whole be done with care.

4th. Of the mixing of mortar, but a word need to be said. If the foregoing principles are correct, the mixing should be very thorough. It should be worked over and over again with the hoe, crin, or mortar mill, so that each particle of sand may be brought into contact with its necessary surrounding of lime.

May it not be inferred, also, that no more mortar should be put between wall faced stone and brick than is just sufficient to make them adhere, since a small portion will more readily harden by the absorbtion of carbonic acid than a large one.

Where lime is cheap, and there is no great need of firmness and durability in the structure which is being erected, lime may be used more freely, the mortar made more hastily, and the sand be less select than above directed. A large proportion of lime constitutes a mortar that is readily used, even when made in a very hasty manner.

The record of falling buildings shows, alas, that too many have been built under the spur of cheapness and haste, with the risk of the durability of the structure and the life of its occupants.

American petroleum is distributed to all parts of the world as the cheapest illuminator......The lamented Agassiz, located the oldest part of the world at the Trenton Falls, New York...... It would take four million years to distribute meteoric dust over the earth's surface in a layer as thick as this paper......

Building in Concrete.—Mr. S. W. Lincoln, an architect of Hartford, has been writing to the *Times*, of that city, about a house built of *beton*, at Port Chester, N. Y. Mr. Ward, a wealthy and enterprising manufacturer, decided about two years ago to have a house that would not burn readily, and he has succeeded in building it. The walls, partitions, floors stairs, cornices, columns, dormers, roofs, and balconies weighing nearly four tons, projecting four feet from the building, are all one solid indestructible mass. Iron girders, encased in beton, are used in the floors and roofs, forming deeply coffered ceilings; but Mr. Embler would ignore the use of iron entirely were he to repeat the work, as he deems the composition sufficiently strong for all practical purposes; and it is evident at a glance that he is correct. The iron beams used are in no case nearer than seven and a half feet between centres. A floor of eighteen feet span sustains a weight of thirty tons of cement, in barrels, without showing the least deflection. (This any one may see who may visit the building.) The roofs are the finest specimens of plastic construction ever seen in this country. A splendid circular colonnade, after the Tuscan order, is a noticeable and striking feature.

The building is two stories high, surmounted with a Mansard roof, with elegant dormer windows. There are two towers, the main one being nearly seventy feet high, and both in the Norman style, with heavy battlements. The reader must bear in mind that this is a structure of elegant and substantial proportions, with heavy medallion cornices, projecting balconies, tower battlements, gargoyles, and all the various forms of thorough construction demanded by good taste; but nothing is overdone, as solidity and simplicity are the prevailing characteristics throughout.

The outer walls are two feet thick, with circular flues running up and connecting with the spaces between floors and ceilings. All the main partitions are constructed in the same manner; and the design is to heat the building by radiation from the partition floors, and ceilings, as the heated air from the furnace is to pass up the partitions and form a general circulation through the air spaces, and return back to the furnace room without directly entering the rooms. This is an experiment, and if successful, will give the speculators upon heat and ventilation something to talk about. Ventilating ducts are carried up in the walls and partitions. Massive chimney pieces are to be constructed of the same material. There are partitions thirteen feet in height, one and two inches thick, firm as a rock. There has been but one thoroughly skilled workman besides the superintendent on the work from the start. This man has had charge of all moulds and forms for cornices, columns, etc. The cost, thus far, is one-half less than if built of cut stone, brick, and mortar.

No insurance will be needed; and this a solution of a vexed question. It will be asked, how has such a work been done? The answer is a simple one. Portland cement, clean sharp sand from Long Island, broken stone, carefully screened, mixed with water—and *brains*. That is about all there is to say, further than that there is no patent, as the materials are not stuck together with gum Arabic, as in the case of some patent stones. The entire substance of the building is nearly as hard as granite, and will take a polish quite like it, as the experiment has been tried.

Heat and Force Produced by the Explosion of Nitro-Glycerine.—The temperature developed by the explosion of nitro-glycerine, has not as yet been determined with accuracy; but as the combustion in the case of gun powder is nearly perfect, the elevation of temperature produced by the explosion of the former is certainly much greater than that of the latter, perhaps more than twice as great.

A volume of gun powder produces, at the ordinary temperature, 190 volumes of gas. Owing to the heat produced, this gas occupies about four times the above mentioned volume, or about 760 volumes of gas are produced immediately after the explosion. A volume of nitro-glycerine produces 1,300 volumes of gas at the ordinary temperature, and admitting that the heat produced by the explosion is two and one-half times that produced by gun powder, this volume would be increased to 13,000 volumes. The force of nitro-glycerine is nearly thirteen times as great as that of gun powder, but on account of the energy of the combustion, the action is still further increased. —*Revue Industrielle*, viii. 458.

A Diamond Drill is to be started on the 1,600-foot level of the California mine. The object is to find out what lies to the eastward. The cast clay wall has never been found anywhere beyond a point 200 feet north of the south line. The