

“Making Portland Cement and Concrete”

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The article begins:

“The growth of the Portland cement industry has been so rapid, especially during the past year (1905), that nearly everyone is now more or less familiar with its character, says *Concrete*. A great many, however, are of the opinion that the word was quite different from this. Portland cement was first manufactured in England by an English engineer by the name of John Smeaton, who discovered, that by grinding together a certain proportion of limestone and clay he obtained a mortar which would harden under water, and to it the name of hydraulic lime was applied. Somewhat later than this Joseph Aspdin took out a patent for an improved cement, made from limestone and clay, which he called Portland cement, because when it hardened, a stone was produced resembling that from the famous quarries of Portland England....”

This article, which begins on the next page,
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Making Portland Cement and Concrete.

The growth of the Portland cement industry has been so rapid, especially during the past year, that nearly everyone is now more or less familiar with its character, says *Concrete*. A great many, however, are of the opinion that the word Portland was taken from the name of some city. The origin was quite different from this. Portland cement was first manufactured in England by an English engineer by the name of John Smeaton, who discovered that, by grinding together a certain proportion of limestone and clay he obtained a mortar which would harden under water, and to it the name of hydraulic lime was applied. Somewhat later than this Joseph Aspdin took out a patent for an improved cement, made from limestone and clay, which he called Portland cement, because, when it hardened, a stone was produced resembling that from the famous quarries of Portland, Eng.

Before this date, in fact more than 2000 years ago, the Romans had manufactured concrete from cement, a great deal of which work stands even to this day. Notably among other work is the dome of the Pantheon at Rome, which is a solid arch 142 feet in diameter, and which is still in good condition. It has recently been thought that the Pyramids of Egypt, dating back 6000 years, are not natural stone, as has generally been supposed, but artificial stone manufactured in their present position. It has puzzled scholars to explain, if these were natural stone, how they could have been transported and hoisted into position by any appliances or machinery of that date. Even the immense amount of slave labor could not have accomplished it without very powerful mechanical contrivances.

Another cement very largely used is known as a natural cement, which played a great part in the construction of the Erie canal and other similar works in this country. In fact, this natural cement was largely used in the building of sidewalks until within the past two or three years. In order to make hydraulic cement, certain proportions of carbonate of lime, generally marl of limestone and clay must be used. In some localities rock is found which is so nearly of the right proportions of these two ingredients, that all that is necessary is to burn and grind this rock. Where the rock happens to be of the correct proportions, a cement is obtained which is practically equal to the artificial, or Portland, which is so common today. The difficulty with the natural cement is, that the rock varies greatly even in the same quarry, and part of the manufactured product would be of a high grade while other portions would be of little or no value. To remedy this defect it becomes necessary to bring a more scientific treatment to bear, hence the erection of the great factories in which Portland cement is now manufactured at about seventy or eighty different places in the United States. By careful analysis and a correct proportioning of the ingredients, a cement of the highest grade is obtained which can be depended upon to set hard, and form a mass in every way as hard and durable as the natural stone would be.

One of the most recent and important uses of concrete is the application to building blocks. This industry has grown more rapidly in the last year, perhaps, than any other in the entire country, and has been taken up very largely in every section. There are practically two methods employed, one is the wet process by which some of the best work, especially at the beginning of the industry, has been done, while the other is generally spoken of as the dry process. This latter seems today to be obtaining the preference over the wet system, principally because of economy in manufacture. There has been considerable difference of opinion, even among engineers, as to which is the better. In the

larger amount of concrete work that is done, sufficient amount of water is added, so that, in tamping, the water is drawn slightly to the surface. This is the method usually pursued by the railroad engineers in grout construction. In the manufacture of building blocks by the wet process, the best known method has been that of the Stevens, in which ground rock dust and cement are mixed with water to the consistency of cream. This is then poured in sand molds and the excess of water allowed to drain off. Separate molds are made for each block, the same as for the casting of iron, and the expense was considerable. Others who believed in this wet process modified it by using sheet iron molds, and pouring the thin mixture the same as by the Stevens process. It requires from twenty-four to thirty-six hours for this wet concrete to set in the molds, and, therefore, a large number of molds and an expensive outfit is required. For this reason the large number of firms manufacturing concrete building blocks are employing the dry process. The sand and cement are first mixed dry, and then only sufficient water added so that the material will pack nicely in the mold. This should be tamped very hard, after which the sides of the molds are removed and the blocks carried away. There are a few block manufacturers who use pressure instead of tamping, some of them hydraulic and others the ordinary toggle presses.

Quite recently a pneumatic tamper has been adopted, and has been used to quite good advantage. There is also on the market a mechanical tamper operated by a flexible shaft, so that it can be conveniently handled. One should not allow the word hydraulic, as applied to the presses, or pneumatic used in connection with the tamping devices, to confuse them. The hydraulic part of the press has nothing whatever to do with the finished block, but it is the only method of applying the pressure. There is still quite a diversity of opinion concerning the relative merits of the different systems.

There is, perhaps, more in the man manufacturing the blocks than in the method which he employs, it being possible to do good work by any of the systems, and very easy to do poor work through careless workmanship. In the manufacture of concrete for blocks, only the best standard make of Portland cement should be used. The sand should be clean, sharp and free of clay, loam or vegetable matter. The material should be thoroughly mixed dry, and then the desired amount of water added. Perhaps more inferior blocks are made because of poor or insufficient mixing than for any other reason. It can be recalled that, in mixing lime mortar, the batch is thoroughly worked over for nearly half an hour before the white streaks disappear and an even color is obtained.

Blocks properly made in the proportion of one part of cement to four or five of sharp sand, will have a compression resisting power of about 2500 pounds to the square inch at the end of sixty days, and will continue to harden with age, and not reach their ultimate strength for a year or more. Concrete is one material that does not deteriorate from moisture, but, on the contrary, is improved. During the past year a large number of residences, factories, warehouses and other buildings in various sections of the country have been constructed of concrete blocks with very pleasant results. This material is not only cheaper than other building materials but is more desirable and durable. The work of this year has demonstrated conclusively the superior merits of concrete as a building material, and it is sure to grow very rapidly with increasing favor from this time forward.