

WORKING IN STONE.

THE quarrying and working of stone is one of the earliest industries in which men engaged, and very little experience would make known the fact that certain stones possessed rich colouring and veining, which was made apparent when surfaces were rubbed smooth; and so the first work in marble would be produced.

The introduction of the mallet, the chisel, and the drill is lost in antiquity. These tools were in use at the most remote period of which we have any record. The sculptures of Egypt are the oldest which the world possesses, dating as far back as 3,000 B.C. Many of these were not only shaped by the chisel, but they were polished with great care. The rude limestone blocks which now form the steps of the Great Pyramid were at one time concealed from view by a casing of polished marble, which must have given the great pile an appearance of dazzling brightness.

We learn from Herodotus that it was built in steps, every step forming the scaffold for the next until the top was reached; then the finishing process was commenced from the top downwards by fitting in angular blocks of marble and polishing the surface to a perfect level.

Saws without teeth, fed by hand with sand and water, were used to cut the slabs with which the walls of the palace of Mausolus at Halicarnassus were lined. Pliny describes the saws and the kind of sand with which the slabs were sawn, and speaks of the palace as being encrusted, or veneered throughout, with marble. It was built 350 years before the Christian era. Saw mills for sawing stone, driven by water power, were in use on the River Roer in Germany in the fourth century. Very little progress appears to have been made in this direction, because we find as lately as the early part of the sixteenth century that one of the inventions of Leonardo Da Vinci was a marble saw, which consisted of a frame in which two or more blades of iron were stretched, thus forming a gang. A copy of Leonardo's original design was published in Scribner's Monthly Magazine some few years ago. According to an English building journal the honor of first establishing in Great Britain mills for the sawing of marble by means of water power, and on an extensive scale, belongs to Mr. William Colles, of Kilkenny. About the year 1730 he tried a model in a small stream, and finding it succeed, took a perpetual lease of a marble quarry in the neighborhood, and set up a mill, which is still in existence, and worked by his descendants. A few years afterwards (in 1748) machinery for sawing and polishing marble by means of water power was established at the village of Ashford, near Bakewell, in Derbyshire. Since that time a great many improvements in the details of sawing machinery have been introduced, but the arrangement sketched out by Leonardo Da Vinci remains practically the same, and is in general use to-day. The principal improvements have been: An arrangement by which sand and water has been fed to the saws automatically, and variations of a clock-work mechanism, by which the saws are gradually lowered into the cut, and which can be made to work faster or slower, according to the hardness of the stone to be sawn. Perhaps the best sawing machine for general purposes is that invented by Mr. Richard Cox. The great objection to the ordinary type of machine is that it takes up too much room; a long shaft is employed to connect the frame with the crank, and this, together with

the length of the saw frame itself, takes up a space which can sometimes be ill afforded. In Cox's machine the connections are fixed to the centre of the frame, instead of at one end of it, and the whole of the driving gear is fixed to the machine itself, so that there is no thrust, and no vibration. The whole of the mechanism of the saw being contained in one framing, the weight of the block of stone to be sawn is ingeniously brought into service, and keeps the machine perfectly steady while it is in work.

An altogether different principle had its origin in Belgium. The machine is called the Helicoidal saw, and is said to produce the most wonderful results. It consists of an endless metallic cord made of three steel wires twisted together to a particular pitch. The cord is carried round two grooved pulleys and is drawn through the cut. It is supplied with sand and water, as in the ordinary saw. Besides the running movement the cord receives a rotary motion which continuously throws the mud produced by the sawing out of the cut. The result of the simultaneous running and rotary movement of the cord is that the sand is rapidly carried along the line and over every point in the cord made by the twisted wires. This combination joined to the continuous movement gives great rapidity of work. The machine has sawn through a surface of 150 superficial feet of white Carrara marble in twelve hours, and through 15 superficial feet of hard Brittany granite in the same time. It has not yet been introduced into this country, but if actual working proves the truth of the experiments made by the inventors, it should not be long in coming into active service. It has already found employment in several of the Belgian quarries.

When marble comes from the saw the surface has yet to be smoothed and polished. It is first rubbed with fine sand, then gritted or pumiced, and finally polished by means of a block on which putty powder or lead has been laid. The machines employed in Italy for surface rubbing are of very rude construction. A bed of thick marble slabs is first laid down in a circular form, and a large wheel-shaped framing of wood divided by spokes into four or five compartments, is made to revolve over it. The slabs of marble to be rubbed are placed in the compartments, sand and water is thrown on the bed, and the revolving wheel is set in motion. As it goes round it carries with it the slabs, which are thus rubbed on those below, until the requisite fineness of surface is produced.

The rubbing bed principally in use in this country is of cast iron. A plate of this material, some 2 inches or 3 inches in thickness, and 8 feet to 10 feet in diameter is made to revolve quickly, and carries on its surface the sand and water required. The slabs are placed face downwards on the plate, and the required work is speedily and easily done. Another machine for rubbing large and heavy pieces of stone consists of a heavy iron plate 8 inches to 12 inches in diameter pierced with holes, and made to revolve by connection with a vertical shafting. The sand and water is placed inside the plate, and finds its way out through the holes upon the work below; the weight of the revolving plate does the rest.

Numerous plans and all sorts of extraordinary materials have been used and recommended for speedily polishing the sanded surface of marble. Practical experience proves that nothing in this process will take the place of good, honest, hard rubbing. This can be best