STONE SAWING.

[From Byrne's Handbook for the Artisan.]

The softer varieties of stone admit of being cut into slabs and smaller pieces with toothed saws, which are sometimes made of a similar form to the cross-cutting saws for wood with upright teeth; but the toothed saws for soft stone are generally made somewhat wider in the middle than those for wood, so as to make the blade more rounding in the direction of its length, and, instead of being reciprocated backwards and forwards nearly in a horizontal line, as for cross-cutting wood, the toothed saws for stone are used with a swinging stroke, so as to act upon only a moderate portion of the length of the cut at the one instant of time; this is done to reduce the labor, and give the saw teeth more penetration. Some of these very soft stones are worked with chisels and gouges similar to those of the carpenter, and they may even be worked into moldings with planes like those for hard wood, but this is not generally practiced.

Slate is sawn and sometimes planed with cutting tools, very similar to those used for wood, except that they are stronger and applied by machinery, the action being partly cutting and partly forcing off the flakes of slate, as, if the tools are allowed merely to scrape over the surface, their edges become rapidly worn away. But the various sandstones, limestones, and marbles are too compact to be thus treated, and they are consequently worked almost exclusively by the chipping-chisel and various abrasive processes; the chisel being used for such parts of the material as are in excess, as in sculptured works, and the abrasive process being employed for dividing the blocks into slabs and small pieces, which are subsequently ground to the required forms with sand and water. In the case of marble, the pieces are finally polished with abrasive powders applied on rubbers of various materials.

The ordinary saw, used in dividing blocks of stone and marble into flat slabs, consists of a parallel blade of soft iron from five to ten feet long, from four to five inches wide, and from one eighth to one sixth of an inch thick, the blade is perforated near each end with a hole about three quarters of an inch in dameter, for the reception of an iron pin, by which the saw is strained in a rectangular wooden frame. The blade is inserted in the saw kerfs in the upright sides of the frame, called the *heads*, and the pins rest in two notches near the lower extremities of the heads, which serve as the handles of the saw, and are kept distended by the wooden stretcher called the *pole*, placed about a foot from the upper ends of the heads, and rested at each end against a loose block of wood called the *bolster*.

Instead of a coil of string twisted with a short lever being employed for drawing the upper ends of the frame together, as in the saws for wood, this object is effected by the use of a kind of chain made of looped iron rods, with intermediate C-shaped links, for adjusting the total length of the chain, which is furnished with iron loops that embrace the upper ends of the heads. The tenison is given by a right and left hand screw fitted to two looped nuts, attached to the iron rod by C links; the double screw has holes for a lever, by which it is twisted so as to draw the upper ends of the heads of the frame together with great force, and thereby stretch the saw in a most effectual manner.

The depth to which the saw can penetrate is limited by the distance from the edge of the blade to the under side of the pole; the nearer the pole is to the saw, the greater is the stability of the blade, and all the parts of the frame are made detached, so as to allow of their being combined and adjusted to suit the different sizes of blocks of stone. The same pair of heads are used with poles and saws of various lengths, and the pole is placed at different hights from the blade, according to the depths of the blocks of stone. When the latter are very deep, a longer pair of heads are substituted, but long heads are avoided as much as possible, as the stability of the saw frame is thereby much reduced.

The blade of the stone saw, like the metal laps used for grinding generally, does not itself cut the stone, but simply serves as a vehicle for the application of the sand, which acts as the teeth of the saw, and performs the cutting process. The coarseness of the sand that is employed depends upon the hardness of the stone to be cut; for moderately soft stone a coarse sharp sand is employed, and for the harder varieties of marble a fine sand is used; the sand or grit generally employed for cutting stone is obtained from the scrapings of roads paved with flint. The scrapings are sifted through perforated copper sieves, much the same as emery, as it is of great importance that the sand should be clean and free from small pieces of stone, or any other extraneous matters. Should a small piece of wood or a bit of coarse gravel by any accident get into the kerf beneath the saw blade, the little piece would roll over backwards and forwards, and materially impede the cutting of the block, and it then becomes necessary to remove the saw and wash away the obstacle, by pouring water down the saw kerf.

The cutting action of the sand is assisted by a small stream of water, supplied from a barrel placed a little above the block of stone. A small hole is made near the bottom of the barrel, to which is fitted a spigot and faucet, or more commonly a loose wooden peg grooved up the one side, which allows of the escape of a minute stream of water, that trickles down a sloping board placed so as to lead the water into the saw kerf. A little heap of sand is placed near the path of the water, and the workman is provided with a wooden stick with an iron hook at the end, or more commonly an old knife-blade placed at right angles to the stick near its end. This tool is called a *drip-stick*, and is used occasionally to draw forward a small quantity of sand into the running water, which thus carries down the necessary supply of sand for the cut, and the water flows away at the ends of the kerf, carrying with it the worn-out sand and the particles of stone removed in the cutting; the drip-stick is also used for tapping the wooden peg, so as to increase or diminish the flow of water according to circumstances.

The weight of the saw and frame supplies the necessary pressure for causing the penetration of the sand, so that the workman has only to guide the saw, and push it backwards and forwards for the cut, and when the pressure is so great as to render the work too laborious, a counterpoise weight is hung from a pulley placed over the saw frame, to which a cord is attached, so as to reduce the pressure to the required amount. Under this arrangement, the saw works more easily, but it does not cut so rapidly.

For marking upon the block of stone or marble the lines upon which it is to be sawn, as for cutting it into slabs of one or two inches thickness, the block is first shifted upon rollers into the position in which it is to be sawn; it is then mounted upon square pieces of wood called *skids*, with that side of the block upwards which is to constitute the edges of the desired slabs; and, as the blocks are frequently of very irregular forms, it is necessary to make one line around the top and two ends of the block to serve as the basis from which the other lines are set off, much the same as in setting out round timber.

The position of the first line having been determined, so as to allow of the greatest number of parallel slabs being cut from the block, two marks are made on the top of the stone close to the ends, with a piece of soft black slate found amongst coal, and called *black*; a line is then drawn, under the guidance of a straight edge, to connect these two marks, and the line is continued down one end, also with the straight edge. An equal distance is then set off at the bottom of the opposite end, and a line is drawn to serve as a temporary guide; two straight edges, each from two to three feet longer than the depth of the block, are applied to the two end lines, and the workman looks along the line of the two straight edges, to see if they are parallel to each other, or out of winding, in much the same manner as in the application of the winding sticks to narrow works in wood, except that, for setting out the blocks of stone, the straight edges are placed perpendicular instead of horizontal. Should the straight edges not appear parallel to each other, the one at the second end of the stone is shifted at the bottom until the two straight edges are in one plane; the permanent line at the second end of the block is then drawn in the corrected position of the straight edge, and if the work has been correctly performed, all three lines will be in the same plane. The thicknesses of the required slabs are then gaged off from this foundation line, and the lines on the top are *chased*, or cut in about one eighth of an inch deep with a narrow chisel, to form a groove in which the edge of the saw is placed for the commencement of the cut. The end lines are also chased, as the water and sand would wash out the black lines.

Before commencing the sawing, the workman examines with a plumb line whether the end lines are vertical, and if not, wedges are driven under one side of the block, to bring the end lines exactly upright; the saw is then inserted in the groove, and the sawing is proceeded with, care being taken in the first entry to keep the saw quite upright, which is greatly assisted by the hight of the saw-frame. Should the saw make the cut a little oblique to the lines, the position of the saw is slightly twisted in the saw-kerfs of the wooden heads, by blows of a hammer applied on one side of the pins which retain the blade in the frame, and which causes the saw to cut in the reverse direction. The necessity for changing the direction of the cut is, however, avoided as much as possible, as it makes the surface of the slabs irregular from the hollows thus produced. The necessity for grinding out these much increases the labor of producing a flat surface on the slabs, and the thickness of which is also lessened; this it is sometimes an important object to avoid with valuable marbles, which are occasionally cut into veneers for inlaying, which do not exceed one eighth of an inch in thickness.

The length of the traverse of the saw is generally about twenty inches, and a saw is therefore chosen that is about two feet longer than the block to be cut, as the shorter the saw that can be efficiently used the more firmly the blade is held. When two small blocks are to be cut, they are frequently placed end to end with the intended cuts in the same plane; and to prevent the sand and water, called the *feed*, from flowing out between the stones, the interval is filled up with straw rammed in firmly between the two blocks; in the case of light-colored marbles, clean shavings are used for this purpose, as the straw would stain the surfaces unless the slabs were washed immediately afterwards.

After the marble has been cut into slabs with the stone saw, if it is required to be reduced into smaller pieces, or narrow slips, such as shelves, or the sides of chimney-pieces, the slab is laid on a bench, having a flat surface of hard stone, or marble, called a *rubbing-bed*. The lines indicating the margins of the required pieces are marked with the straight edge, and black lead, and the lines are chased with a narrow chisel, as for the entry of the stone saw, but the cutting is effected with smaller blades, called *grub saws*; they consist of plates of iron from one-twentieth to one tenth of an inch thick, from six inches to four feet long, and six to eight inches wide when new. These blades are not stretched in a frame, but are stiffened by having their upper edges clamped between two pieces of wood extending their whole length, and measuring about two inches wide and one inch thick, the whole being held together by means of ordinary wood screws, passing through holes in the plate, so as to form a wooden back something like those of the dovetail saws, and which serves as the handle by which the grub saw is used.

The blade should always be shorter than the length of the cut to be made, as, should the blade be longer than the cut, it would be worn hollow from the greater amount of rubbing to which the middle would be exposed; but when the grub saw is much shorter than the cut, it is liable to be worn rounding in its length. To counteract this tendency, the grub saws are sometimes filed, at every four or five inches, with angular notches about three fourths of an inch deep, and which also allow the feed, or the sand and water, to reach the bottom of the cut with greater facility, and the grub saws are consequently considered to cut rather faster for the notches.

The width of the iron blade measured to the wooden back limits the depth of the cut to which the grub saw can be applied, and, in selecting a saw for any particular piece of stone, preference is given to as narrow a blade as can be fairly applied to that thickness, as, when the blade is wide, it is rather feeble sideways, and it is besides more liable to be twisted from the perpendicular, when rubbed backwards and forwards in the cut, with one or both hands applied on the back of the saw near the middle of its length.

Washing out a Mill Race, or Foundation by Sluicing.

We learned from a friend, a returned Californian, who had seen several attempts made to wash out a race or a foundation by water, and had once tried it, but all these attempts ended in confusion and vexation, for the reason that they were all begun at the wrong end. That is, the water was shot down from a hight above into the foundation, or upper end of the race, without any proper facility being provided for carrying away the gravel and small stones; the result was always the same; the water would excavate a deep hole where it struck, but only the soft loam and clay were melted and carried away by the water, the stones and sand remaining and blocking up the channel, and it was found cheaper and better to plow and scrape the earth out. But Mr. Whipple, the Californian alluded to, has shown us the principle of *sluicing*, which experience has proved to be the cheapest and best method of making such excavations. He sluiced out a tail-race and wheel pit this winter (1869) in a hard gravel soil, in a very short time; he placed a sluice (by nailing three boards together, forming a bottom and sides, and open at top) at the lowest end or discharge of the race, and ran the water down the intended route, and through this first length of sluice into the river. He then commenced at the end of this length and loosened the earth with a pick or crowbar to the required depth and width, and the water, rushing down from the unbroken surface above, swept the earth and stones down the spout into the main stream. When thus exavated to the proper distance, another length of sluice was added, a little straw stuffed under the end, and each side blocked up with stones to direct the water into the end, and another length loosened and sent through the sluice, as before. This process was continued until the race was completed, and the foundation for the wheel-house reached; and here the benefit of Mr. Whipple's Californian experience was more conspicuous than in digging the race, because the depth of excavation here was so great that the earth would have had to be wheeled to get it out of the way, and this is always a tedious process; but he sent all the earth and moderate sized stones down the sluice and river in an incredibly short time; by shifting the chute of water upon different parts, and loosening and throwing out the larger stones, thus giving the rest a proper facility of entering the sluice, it was swept down stream by the water, requiring only a little assistance with a hoe or shovel when large or flat stones would incline to stop and obstruct the passage.

Any person who does not comprehend the assistance which such a sluice renders, to enable the water to carry away stones and gravel, may satisfy himself by trying to shovel or push such gravel and stones on top of their natural bed, and then try to shovel the same, or push them along in such a sluice; or let him try to shovel potatoes from the top of a bin, and then try shoveling them on a wooden floor.

Care should be to place each length of sluice at the full and proper depth at first, and also to give each length an equal and sufficient fall to insure the requisite rapidity of current. By Mr. Whipple's experience, two inches of fall in one length of board, or twelve feet, will carry along stones the size of potatoes, or a man's fist, while three or four inches fall to each length will roll along stones as large as a man's head. Of course, a sufficient supply of water is necessary in all such operations.—*The Practical American Millwright and Miller.*

GLASS WALLS.—Among the novelties in garden arrangements an English builder has lately patented a system of erecting walls of glass. These walls are formed of grooved T-iron. Stands of the required hight are fixed at four or five feet apart into a foundation of brickwork, stone, or blocks of wood, and bound together at the top by a coping which projects three inches on each side. Into the grooves rough plate glass is placed, being held in position by a packing of felt, the slabs being butt-jointed; and thus, when the coping is put on, the work is complete. Nothing can be more simple than the arrangement and construction of these walls, and they are unexceptionable in point of appearance. They are open to objections, but may be useful under some circumstances.

MATHEMATICAL AND OPTICAL.—James W. Queen & Co., the well-known mathematical and optical instrument makers, of Philadelphia, have opened a branch of their establishment in this city, at No. 5 Dey St. Their advertisement appears in our advertising columns. We can recommend this firm to such of our readers as desire to purchase articles in their line or trade.

THERE are two hundred and forty-one and five-eighths miles of paved streets in the city of New York.