POLISHING GRANITE.

The form is given to the stone by the hands of skilled masons, in much the same way as is done with other stones of softer nature. Of course, the time required is considerably greater in the case of granite, as compared with other stones. If the surface is not to be polished, but only fine-axed, as it is called, that is done by the use of a hammer composed of a number of slips of steel of about a sixteenth of an inch thick, which are tightly bound together, the edges being placed on the same plane. With this tool the workman smooths the surface of the stone by a series of taps or blows given at a right angle to the surface operated upon. By this means the marks of the blows as given obliquely on the surface of the stone are obliterated, and a smooth face produced. Polishing is performed by rubbing in the first place with an iron tool and with sand and water. Emery is next applied, then putty with flannel. All plain surface and moulding can be done by machinery, but all carvings or surfaces broken into small portions of various elevations, are done by the hands of the patient hand-polishers.

The operation of sawing a block of granite into slabs for panels; tables, or chimney-pieces is a very slow process, the rate of progress being about half an inch per day of 10 hours. The machines employed are few and simple. They are technically called lathes, waggons, and pendulums or rubbers. The lathes are employed for the polishing of columns, the waggons for flat surfaces, and the pendulums for moulding and such flat work as is not suitable for the waggon. In the lathe the column is placed and supported at each end by points, upon which it revolves. On the upper surface of the column there are laid pieces of iron, segments of the circumference of the column. The weight of these pieces of iron lying upon the column, and the constant supply by the lathe attendant of sand and water, emery or putty, according to the state of finish to which the column has been brought, constitute the whole operation. While sand is used during the rougher state of the process, these irons are bare; but when using emery and putty, the surface of the iron next to the stone is covered with thick flannel.

The waggon is a carriage running upon rails, in which the pieces of stone to be polished are fixed, having uppermost the surface to be operated upon. Above this surface there are shafts placed perpendicularly, on the lower end of which are fixed rings of iron. These rings rest upon the stone, and when the shaft revolves they rub the surface of the stone. At the same time the waggon travels backwards and forwards upon the rails, so as to expose the whole surface of the stone to the action of the rings. The pendulum is a frame hung upon hinges from the roof of the workshop. To this frame are attached iron rods, moving in a horizontal direction. In the line upon which these rods move, and under them, the stone is firmly placed upon the floor. Pieces of iron are then loosely attached to the rods, and allowed to rest upon the surface of the stone. When the whole is set in motion, these irons are dragged backwards and forwards over the surface of the stone, and so it is polished. When polishing plain surfaces such as the needle of an obelisk, the pieces of iron are flat; but when we have to polish a moulding we make an extra pattern of its form, and the irons are cast from that pattern.—*The Stonemason.*

To Fix Pencil Drawings.—First pass the drawing through clear water, go carefully over with skimmed milk, using a camel's-hair pencil, dip in a weak solution of alum, and let it dry flat. Allow a thin solution of isinglass to run over the drawing on perfectly level surface.

THE GEYER-BRISTOL METER FOR DIRECT AND ALTERNATING CURRENTS.*

BY PROFESSOR WILLIAM E. GEYER.

In the meter about to be described we make use of the heating effect of the current. Electric measure instruments depending on this heat effect are not new, as in the Cardew voltmeter we have an application which has found much favour. Here the current of greater or less strength traverses a long thin wire, heats it more or less, and the direct expansion is a measure of the current, and indirectly of electromotive force.

In an ammeter it is necessary to keep down the resistance, and I therefore doubt whether direct expansion can be usefully applied for this purpose; for the actual elongation of a bar of metal, even when raised through a considerable range of temperature, is very small. In the familiar compound bar we have a case where a very small actual elongation produces a relatively very great lateral displacement.

I think I shall best be able to explain to you our meter, by recalling to your minds this old device. In the simplest compound bar two strips of metal which have different coefficients of expansion are securely soldered flatwise along their entire length. Brass and steel are metals frequently employed. On heating, the brass expands more than the steel, and, in consequence, the bar bends, becoming convex on the side of the brass. When such a bar is heated by the passage of the electric current, it will deflect, and this deflection may be made a measure of the current. The disadvantage of such an instrument would be that atmospheric changes of temperature would also cause deflection, so that troublesome corrections would have to be introduced.

In our meter we also use a sort of compound bar, but eliminate at once the effect of the surrounding temperature by taking metals whose coefficients of expansion are the same or sensibly equal; in fact we take the same metal. Our first form of construction was as follows:—A wire of German silver is laid upon a strip of German silver of considerably greater cross-section and radiating surface. The wire and strip are soldered together at one end, separated for the remainder of the length by a film of mica, then tied together at frequent intervals with silk or other insulating material, and suitably supported or clamped at the unsoldered end. If now a current, either continuous or alternating, is allowed to enter the strip at one end, it runs along its length, there enters the wire, and leaves the instrument at the other end of the wire.

For a given current the wire, on account of its greater resistance and also on account of its smaller radiating surface, becomes hotter than the strip. In consequence of the difference of expansion the bar bends, becoming convex on the side of the smaller conductor. This combination we call a differential bar.

We would also state that inasmuch as the results obtained by the use of this instrument are due to the excess of the heating effect of an electric current upon one portion of the bar, or its equivalent, over the other, it is in a measure immaterial to the principle of the invention whether the current which produces the differences in temperature be caused to heat the two parts directly or indirectly. For example, the more expansible part, in lieu of being included directly in the circuit, may be arranged in close proximity to, but insulated from, a wire or conductor which is heated by the current. The other part or element may be in the circuit or not, but in either case formed or arranged to be less sensibly heated than the other.

It will readily be seen, however, that to heat one or both of

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