ROCK DRILL AT VIENNA EXHIBITION.

Mr. Herman Osterkamp, of Aix-la-Chapelle, exhibits at Vienna the rock drilling machine which we illustrate on pages 104 and 105. This rocky drilling machine consists essentially of a cylinder and piston, the piston filling the cylinder partially and being rendered air-tight by a packing made of five or more rings or recesses turned out on the surface of the piston. In the same manner the piston rod is kept air-tight in the cover of stuffing box through which it works. The drill is fixed to the outer end of the piston by a wedge. The other end of the piston rod is formed square, and embraces a rod which passes through the cover of the cylinder, and has a bevel wheel fixed thereon for imparting rotary motion to piston. The piston at the same time works up and down the cylinder with the piston rod. The rotary motion of the aforesaid bevel wheel and piston and drill is effected by a second bevel wheel fastened on an axis which has a toothed wheel. The reciprocating movement of the piston is effected by the distribution of the parts and their construction which essentially differs from drilling machines or engines as heretofore constructed. At the side of the aforesaid cylinder and in connection with it, is attached a smaller cylinder fitted with a piston the rod of which has two ports or passages formed therein, forming a slide valve for admitting and cutting off the compressed air as desired.

In our engravings Fig. 1 shews a section of the cylinder and piston, *a*; and Figs. 2 and 3 shew the outside of the cylinder X. The piston *a* fills the cylinder partly and works tight therein by an air-tight packing produced by five rings, B, turned out on the surface of the piston. In the same manner the part C, of the piston is tightened in the cover, *c*, as in a stuffing box, and the drill is fixed at the end of the piston by a wedge at 1, the other end of the piston rod being formed with a square aperture to receive and embrace a rod *d*, of the same shape. This rod passes through the cover of the cylinder and terminates in a bevel wheel, *e*, by which it can be turned round in the cover of the cylinder, turning at the same time the piston which also moves up and down with the piston rod.

The rotary motion of the bevel wheel and piston, and the drill 2 fixed thereto, is effected by a second bevel wheel, *g*, fastened on the axis, *f*, which has a ratchet wheel, *t*, fixed on it. At the side of the cylinder X, and in connexion with it, is attached a smaller cylinder, *h*, fitted also with a piston, the rod, *i*, of which has at the back end two different apertures, *k* and *l*. When the pistons of the cylinders are in the positions shown at Fig. 1, the compressed air, which is the motive power to be employed, streams out of the tube through the aperture, *k*, of the small piston into the working cylinder, X, pressing the piston and with it the drill forwards until the upper end reaches the aperture, *n*, then the air enters into the distributing cylinder, *h*, pressing likewise the piston *o*, forwards. The aperture, *k*, in the distributing rod then goes beneath the entrance A, of the cylinder, and when the working piston continues its course to the fore end of the cylinder, the opening *l*, of the distributing rod comes against the entrance A, thus effecting the communication of the compressed air in the cylinder with the atmosphere.

At this moment the working piston goes backwards, driven by the compressed air of the common reservoir, which communicates without interruption with the lower part of the piston by the channel *r*. Immediately after the fore part of the piston has reached the lateral opening *p*, the air goes also into the distributing cylinder, driving its piston backwards into the piston shown at Fig. 1, and also the piston in the cylinder X. This movement then begins again when the working piston goes forward, the compressed air which was before it returns to the reservoir, whilst the small volume of air which was working in the smaller cylinder passes through the small opening *g*, into the open air.

On the back end of the distributing rod is fastened a pawl, 3, for moving the toothed wheel, *t*, forwards at each stroke of the piston, and with it the axis, *f*, and the working piston, *a*; a catch, *u*, prevents the wheel going backwards. The drilling machine is fastened to a support *b*, by a wedge, and this support can be moved to and fro on a frame, *e*, by the screw, *d*, and the crank, *c*. Two rods, *f*, fastened to the frame in combination with a third rod *g*, which can be shortened and lengthened form a stand, which in most cases is sufficient for the use of the machine without any need of fixing it otherwise. The moving forward of the drill is by the workman by means of the crank, *c*, on the screw, *d*. The man who works the machine is always able without any difficulty and without the least loss of time to effect the moving forwards of the drill and to accommodate this precisely to the degree of hardness of the rock. Figs. 4 and 5 give two views of one of these machines mounted on its support.—*Engineering.*

ON MORTAR AND CONCRETE.

Read before the Edinburgh and Leith Engineers' Society, by Mr. R. C. Reed, C.E, March 5th, 1873.

The importance of mortar and concrete as building materials is so great, that a few notes on the subject may not be uninteresting to members of this Society, and ought to be the means of raising a discussion by which some valuable practical information may be elicited. I do not intend to go into the chemistry of limes and cements, because my knowledge of chemistry is not sufficient to throw any additional light upon them than what has already been written. It will be sufficient for my purpose to classify the cementing materials as follows: 1st, rich limes; 2nd, hydraulic limes; 3rd, cements.

Rich limes consist of almost pure lime, such as may be obtained by calcining marble, which is nearly a pure carbonate of lime; the heat having the effect of purging the limestone of all water and carbonic acid, and of producing the material called quick lime. When rich quick lime has had water applied, a rapid disruption of the particles and effervescence takes place, and the solid shell falls into powder. This is called the slaking process, during which time a great amount of heat is given out. The mortar made from rich lime mixed with sand will never set in water, and even in the air it only hardens by absorption of carbonic acid from the atmosphere, thereby bringing it back to its original condition of carbonate of lime, with the addition of sand. This, however, is a slow process, and where the mortar is in thick masonry it will take centuries before carbonate of lime is formed all through, and by that time, if the masonry has stood, the hardening will not do it much more good.

The second class, viz., hydraulic limes, are so called owing to their property of setting in water. They consist chiefly of a mixture of lime, silica, and alumina—that is, lime and clay. There are sometimes other foreign matters, such as iron, magnesia, &c.; but they form a small portion of the whole. When burnt into quick lime, it may be slacked with water like the rich lime; but the disruption of the particles and the heat given off is not nearly so violent as in the case of rich lime slaking, and, indeed, some limes will hardly slake at all without being previously ground into fine powder; the Elgin or Charleston lime and the Arden lime are instances of this, and they are the best hydraulic lime in Scotland.

The third class, viz., cements, may be called "very eminently hydraulic limes"—that is, with a great proportion of silica and alumina. They set rapidly either under water or in the air, and have to be ground and finely sifted before being used, as they would not otherwise slake Rich limes may be made to set under water—that is, made artificially into hydraulic limes by the addition of calcined clay; and, indeed, Portland cement is nothing more than the chalk and plastic clays found in the London basin, mixed up together, burned, and ground to a fine powder.

The ingredients chiefly used for making mortar in this country are, of course, lime, sand, and ground smithy ashes, mine dust, burnt bricks, and tiles. In foreign volcanic countries, such as Italy, they use what is called puzzuolana, which is a kind of clay that has been subjected to great subterranean heat. The quality of sand used is of great importance. It ought to be clean and sharp, or angular, so that the lime or cementing material may get thoroughly into every pore. If it be a loamy sand, for instance, the particles will be often sticking together in clods, and are thereby kept from being cemented together. The sand, then, ought to be perfectly clean, so that each grain may get completely surrounded with the matrix of lime or cement. Yet how often do we see builders in this city deliberately making their