

absorption of water, unless they were reduced by grinding, was almost impossible.

There is also another possibility—namely, that these comparatively large particles became surrounded by a watertight skin or coating of cement, which stopped their further hydration. The author is inclined to believe that the cements of the present day are not as highly burned as formerly, and that the slow hydration of the coarser particles is thereby facilitated. There are many leading authorities in Germany who stoutly maintain that the "idea that lightly-burned cement should be rejected is an erroneous opinion, if the present state of cement making and testing be considered, and that no cement is more reliable than one which gives good results, even when lightly burned." The meaning of this is that they recommend fore-going some of the advantages of high burning if it will ensure them a really finely-ground cement. Before we adopt any such proposition we must be prepared to insist on our cement being ground to the present German standard.

The time appears to have come when we may reasonably ask for finer cement than is now generally sold in the English market. We can get cement made in England at present which will entirely pass through the sieve of 2,500 meshes per square inch, leaving a residue of about 8 per cent. on the 5,800 sieve, and about 30 per cent. on the 32,000 sieve. But the author knows of no cement in this country which approaches in fineness some of the cements of Germany; for cement can be obtained in that country so fine that only a residue of from 3 to 10 per cent. remains on the sieve of 32,000 meshes per square inch, and, in some instances, so fine that it all passed through this sieve. To get such cement we must abandon high weight tests, as such a finely-ground cement will not weigh more than 70 lbs. per cubic foot in its dry uncompressed state. In this connection it may be worthy of remark that in the standard tests for Germany no tests are laid down for weight or specific gravity and it is a matter of considerable doubt whether we should retain such tests in this country, or even adopt a chemical test, as has been so strongly recommended by some chemists and engineers.

"Free lime" has long been the dread of engineers using Portland cement, and as a safeguard, many authorities have considered it desirable that cement should be stored for a considerable time and spread out in thin layers to "cool," or "air slake." It has been maintained that by so doing the cement is made safe for use, and that there will be no danger of its expansion and cracking. There are high authorities and scientific experts who now are equally positive that such treatment is not only not required with a high-class cement, but is actually injurious to it.

In the light of what has been discussed in this paper it is worth while examining these conflicting views. What are the effects of cooling cement with which we are familiar? First, the cement takes longer to set; second, the cement loses its strength; third, the cement increases in volume and consequently loses in weight. This "air-slaking" means the absorption of moisture and carbonic acid by the finest ground portions of the cement, rendering them inert and thus weakening the cement. If this air-slaking is continued sufficiently long the cement will become worthless, the coarser particles gradually absorbing moisture and carbonic acid. An examination of various analysis shows the presence of both moisture and carbonic acid in varying proportions. It seems more probable that air-slaking is a safeguard against under-burned and badly-ground cement than against the presence of so-called free lime. In such a cement the finely-ground portion of the cement would set rapidly, while the coarser particles hydrating at a later stage would swell and crack the cement. Air-slaking would, however, prevent this by rendering the finest portions of the cement inert through the absorption of moisture and carbonic acid, thus leaving only the coarser portions to act as cement. The natural result is, of course that after such cooling the strength of the cement is reduced. The true remedy seems to be the manufacture of a cement so finely ground as to be uniformly active, and if this cement is highly burned the results will probably be all the better.

In conclusion, the lessons we may learn from recent additions to our knowledge of Portland cement are: First, the paramount importance of fine grinding; second, the absolute need of using sufficient water to ensure the complete hydration of the cement; and, third, the necessity of making concrete exposed to the action of sea-water impermeable.

Mr. M. Ryan, brickmaker, of Smiths Falls, Ont., has made arrangements to operate all the machinery in his brickyard by electricity.

The Toronto Lock Co., who make an announcement in the advertisement pages of this paper, have lately commenced the manufacture in Toronto of the finer grades of builders' hardware.

With regard to ink erasers, Mr. James F. Hobart, of Brooklyn, N. Y., writes: In recent issues of *Carpentry and Building*, "J. W. G." and "S. P. G." recommend as good ink erasers broken glass and half worn sandpaper. They will do the work, but better results may be obtained by using a bit of rubber that has been prepared for erasing ink by having incorporated with it during the process of manufacture fine emery or other abrasive material. Separate pieces of ink eraser rubber can be had, or there may be purchased at any stationer's neat bits of polished wood with a piece of ink eraser projecting from one end and an ordinary pencil eraser from the other. After using the ink eraser it is well to go over the work with the ordinary rubber, in order to remove the grit that may remain.

## USE OF LIME IN MORTAR.

THERE is a common superstition, which probably retains its hold upon builders solely through the profit that they find in maintaining it, but which, says the American Architect, sometimes really imposes upon laymen, to the effect that cement mortar is improved, in cold weather, by the addition of lime to it. As the mason ingeniously explains to his employer, the heat developed by the lime, in slaking, keeps the cement warm, and thus prevents it from freezing; and, on this theory, the advent of a frosty day is utilized by multitudes of sharp builders to load the mortar, which they have agreed to make of sand and cement only, with a quantity of lime, which saves cement, and makes the mortar easy to work, but destroys its water-proof qualities and injures its strength and hardness more or less, according to the quantity used. It is hardly necessary to say that the influence of the lime in "warming" the mortar is purely mythical. Lime mortar, without cement, is not much injured by freezing, while cement mortar is totally ruined, so that a mortar containing a large portion of lime would be harder, after freezing and thawing, than one containing cement only; but it would gain the qualities of lime mortar only as it lost those of cement mortar.

The fact is, that the only time when it is desirable to add lime to mortar, which the contract requires to be made with cement, is in the summer. In very hot weather, cement, particularly of the quick-setting sorts, will sometimes harden in the mortar-tubs before it can be used. The average workman chops up the lumps, and re-tempers them, with more water, but this proceeding destroys half the value of the cement, and it is preferable, under such circumstances, to add a small quantity of lime to the cement, at the first mixing. A very small dose of lime will retard the cement long enough to make it manageable, without materially injuring its properties, and circumstances sometimes render it absolutely necessary to resort to such an addition, in order to be able to work the cement at all. In winter on the contrary, the object to be aimed at is to accelerate the setting of the cement as much as possible, so as to place it beyond the reach of injury from frost, which, if kept out for twenty-four hours, has little effect on good cement. In order to secure this rapid setting, however, all traces of lime, which is a powerful retardant, must be kept out of the mortar, and the bricks or stones which are to be set with the mortar must be thoroughly warmed before they are laid. To warm the mortar is perfectly useless. A bed of mortar, spread on one cold stone, and with another cold stone lowered into it, will freeze completely through in a few seconds, even though it may have been boiling hot when it was spread; and we have seen in a warm day, with the temperature well above the freezing-point, stonework in cement mortar freeze almost as fast as it was laid, simply because the stones had been cooled down during the cold day and night previous, and had not time to get warm. It is obvious that, roughly speaking, it would require four tons of mortar at a temperature of forty degrees Fahrenheit, to raise a single stone, weighing one ton, from zero to thirty-two degrees, so that the whole mass would be just on the verge of freezing; yet the masons would have us believe that by adding a little lime to the mortar, they enable a hod-full of it, not only to raise above the freezing point the temperature of a large mass of masonry from a point in the neighborhood of zero, but to hold it there, notwithstanding the temperature of the surrounding air, until the cement has had time to set. By warming the stones, or bricks, the conditions are reversed. A heated stone will keep the mortar in which it is laid above the freezing point as long as it remains itself above that point, and as either stone or bricks lose heat very slowly, it is easy to build in the coldest weather, a wall which will retain, in the interior, a temperature above the freezing point long enough to make the cement in which it is laid secure against frost, except in the superficial portions; and with suitable coverings, these may also be protected. Mr. O. W. Norcross, one of the most ingenious and careful of builders, warms foundation-stones with a jet of steam, before laying them in cement in cold weather, but this is an expensive process, if thoroughly carried out, as the heat penetrates very slowly into the mass of the stone; and a better way is to pile the stone or brick over a furnace of some sort, in which a moderate fire can be kept night and day. We have once or twice made use of the low flat furnaces used by the workmen for heating pebbles who lay coal-tar concrete. Three or four thousand bricks can, with care, be piled over one of these furnaces, the chimney coming up through them, and by renewing them as fast as the hod-carriers take them from the pile, the masons can be constantly supplied with hot bricks, which will make excellent work with cement mortar, in the coldest weather; and as the furnace is tight, there is no danger of spoiling the appearance of the bricks by smoke.

A majority of the contractors of Montreal have acceded to the demand of the carpenters' union for a nine-hour day at 20 cents per hour. The new scale of wages will come into operation on the 1st of May.

The Mayor of Toronto has expressed himself as being in favor of the amalgamation of the Central School of Art with the Toronto Technical School. The art school is seeking to have the yearly grant from the city increased from \$500 to \$2,000.