

concrete. The blocks need not be more than 2 in. thick and 6 in. long by 3 in. wide. They should be dovetail grooved at the bottom, burnitized before using, and bedded in cement. Powdered cement should be brushed into the interstices after the laying is complete, and the surface well washed with pure water and left clean.

Deal, pine, pitch pine, oak, walnut, teak—most kinds of wood will do, which may be planed or polished, and laid in any variety of pattern, equivalent in beauty to a parquet floor. Where there are no basements it would be better that all the rooms should be thus paved, the difference in the purpose of the rooms being expressed by the character of the design and the quality of the material used. Vitreous porcelain tiles are best for passages, being both impermeable and not slippery on the surface. But excellent tiles of every kind are now available for the purpose, and are most easily kept clean.

IMPERMEABLE WALL CONSTRUCTION.

In the second place, let us consider briefly the case of the enclosing walls of a building. Nothing but the observation of carefully conducted experiments will enable you fairly to realize the remarkable porosity of the ordinary building materials used for the external walls of dwelling houses.

The impermeable qualities of terra-cotta, give to it a foremost place in the decorative construction desirable in all buildings. Mr. Waterhouse has proved its value as a material for use in the metropolis. The Natural History Museum has the exceptional advantage of being, as it were, cased in terra-cotta. In the erection of buildings of the ordinary porous materials, however, precautions may be taken to achieve a similar result. There are a variety of systems for forming hollow walls, the inner and outer casing being connected with strips of bent iron galvanized. But hollow walls are not always efficient, and are rarely perfectly well done, and, of course, leave a space into which bad air can accumulate, and vermin may some day find their way and be unable to get out and die, and thus fumigate the building. The system is costly too, and covers a larger area than solid walls.

There is another system which makes a wall at once air and water proof so far as it extends, leaving nothing but the crevices in the ill-fitting of the joiner's work of doors and windows which only good workmanship can eliminate. It consists of an asphalt bond between the inner and outer casing, applied in the following manner. Let us suppose a $14\frac{1}{2}$ in. wall, on one side 9 in. of brickwork, on the other $4\frac{1}{2}$ in., with 1 in. division between, the opposite joints being left free of mortar for about three quarters of an inch each. At every two or three courses the heated asphalt is poured in, and the crevices all filled up with this impervious material, and the result is a wall much stronger than the ordinary wall, occupying no more space, and perfectly wind and weather proof. Impermeable water tanks may thus be constructed, an example of which may be seen in the Parkes Museum.

In facing with stonework, this will be found a valuable accessory, but the preservation of the face of the stone will not be secured, and another and a wider question is opened up as to the best kind of preserving solution for treating stone and other porous facing materials, and preserving it from the action of the weather and disintegrating gases afloat in the atmosphere, and found to be so destructive in London, and the manufacturing towns of the provinces. But before discussing this question, let us return to the impervious walling, to observe that there is still a weak point not rendered impregnable to damp air.

DAMP COURSES.

The asphalt must not only be applied vertically but also horizontally at the foot of the wall and at the level of the lowest floor adjoining. In fact, the asphalt may be continued at the level of the underside of the wood block basement flooring, and so seal up the walls and floor.

The horizontal course in walls is called a damp course, and is usually applied, but when it is absent the result is that damp rises in the walls forced up by the pressure of the ground air by the variations of temperature, by capillary attraction, &c., and the plaster becomes demoralized and falls off the walls, and considerable discomfort and expense is the consequence.

PRESERVING SOLUTIONS.

This was the subject of an interesting discussion at the Institute many years ago, under the presidency of the late Sir Wm. Tite, and in the transactions of the Institute the whole matter was very carefully reported. I invariably specify that

the stonework shall receive when in a dry state, two coats of a solution, the effect of which is to render the surface of the stone comparatively impermeable, at all events, till such a time as the stone has had time to weather and form its own skin and natural protector from the weather. In fact, wax and gum are dissolved in a spirit, and the solution is applied with a brush on dry stonework; the spirit volatilizes, and the congealing of the rest forms a skin as thick as the stone is impregnated; two coats are usually sufficient.

At Hanover Church, Regent Street, may be seen three different processes, none of which have as yet shown signs of failure. The building had become perfectly black, but very few signs of decay had taken place except in the towers, and I was desirous of removing the soot without taking away the weathered surface of the stone, and this I achieved by the use of the wet steam jet. I also discovered that the portions which had been treated with linseed oil when first erected fifty years ago had not decayed to any extent, while the rest was so far gone that the greater part of the stones had to be replaced.

Of course a great deal of the defective stone we see arises from injudicious selection; there is good and bad stone of every kind, and unless pains are taken not only to select the quarry itself, but to mark the approved stones at the quarry, and then to see that they lie in the building on the same bed that they lay in the quarry, disappointment must ensue whatever the solution you employ. Solutions should only be used to preserve good stone, not to make bad stones pass muster.*

THE ROOF.

A very few words must suffice to dispose of this subject, having regard to our limitations as to time. It is not my intention to speak of flat roofs of fireproof construction, and covered with impermeable materials of various kinds; obviously they are rarely required, and, when wanted, only need to be well executed to answer the purpose intended. But the ordinary house roof is a thing that forms a hat to a building; it may or may not have projecting eaves, or a brim to the hat, but it is always presumed to rise above the greater part of the topmost rooms, and to form an air space protective of the inmates from the extremes of heat and cold. That this is but a presumption is, in many cases, only too true, and the cruelty of putting servants in slate, or even metal-covered attics, within a few inches of the outer air, is often forgotten alike by the builder who sells and the master who buys his family residence.

The ordinary speculative house-builder gets the thinnest slates, often absorbent of moisture and permeable by the sun and wind, and he fixes these with common nails to sappy battens, secured to light rafters at the least available gauge, instead of making every third slate lap the first at least three inches, and be fastened with two copper nails to each slate to inch rough boarding, through which the snow may be further prevented from finding its way by putting an intermediate layer of non-dorous felt, and thus keep back the heat and the cold and the rain and the snow, and form a sound external covering to the house.

Zinc does not last above a dozen years in the English climate as a rule; but if used, it should be put on with laps, and without soldered seams or anything to hinder its free expansion or contraction, and should be put in much thicker than is customary—not less say than No. 15 gauge.

Lead forms the best and most durable roof covering, properly laid, of sufficient thickness—say 5 lbs. weight for the square foot for ridges and flashings, 7 lbs for gutters and flats. But nothing is more effective than tiles, and nothing, when well done, warmer in winter or cooler in summer. The Broseley tiles are admirable in colour and hardness.

Projecting eaves are a great protection to the walls; and the projections on the face of the walls for cornices, labels, strings, should all be well under-cut, not only because of the good effect of a sharp shadow, but because the water is thus prevented from running down the face of a building and disfiguring it, and making it damp.

VENTILATION.

It is not my purpose to enter very deeply into the question of ventilating and warming, but it is obviously necessary to make suitable provision for ventilation not only for the purposes of human respiration, but for the sustenance of the

* I have had models made of an ordinary brick wall, and one with asphalt core, both of which I have fitted with clips to show the passage of the air through one and its exclusion in the other.