evening, or several evenings; and yet were limited, in the length of their papers, to something which could be read in less than half an hour. The result was that, for the most part, they were occupied with the elementary facts of the matter. They skimmed over too large a surface, and had not time to go down to the treasures below.

Yet the treatment of painted glass, which was practically confined on this occasion to that of figure subjects, is only a small part of the question. It may be the highest part, but it is also, for most architects, the exceptional part. Every building, from the cheapest to the costliest, contains window glazing; and to many people it is constantly in view through a great part of the day. How to improve "domestic" glass is, therefore, for most of us a more intimate and pressing question than how to deal with the "storied windows, richly dight," of churches and monumental structures. We have outlived the time when a gigantic sheet of "British plate" satisfied the highest ambition of the British householder. We are in a period which is trying, like the olden ones, to apply art to common things. But though common things in brickwork and woodwork and metalwork are getting their share of attention, common things in glazing seem to be rather neglected. It is rare to find anything of this sort with a trace of art about it between elaborate stained glass and plain 21oz. sheet.

Then, again, the essential things which pertain to glass—which distinguish good glass from bad—are largely things relating to color and quality; to color and texture, if one may use the latter word for want of a better. Now, these are precisely the things which words cannot describe, and which diagrams cannot display. To make it clear which glass is excellent and which is execrable, the only way is to show the glass itself, and to show it by daylight. The difficulty is, that this can seldom be done at an evening lecture. Specimens can be handed round, but their real tints and tones when sunlight passes through them can hardly even be guessed at. And a passing glance at such specimens is not enough. They need to be stored where an architect can return and study them at leisure. They should, in short, form part of a permanent and easily accessible collection. It need be little more than a collection of samples. It is not figures of saints and angels that are wanted. It is a lot of pieces of glass of all kinds and colors, old and new. The old pieces should be marked with their date, or approximate date, and place of origin; and the new pieces with their makers' names. They would have to be fixed in leads, perhaps, for security; but there must be no labels requesting visitors "not to touch." The object is to afford facilities for getting to know them thoroughly, both by sight and feeling.

With such a museum of samples as this—a museum which, even if it occupied only one small and well lighted room, would be infinitely better than nothing, every architect would have it in his power to ascertain what glazing materials were actually available, and would be able to design his work accordingly. Of course, the scheme is not ambitious enough to attract the support of the nation or of the public. We are not likely to see it carried out at South Kensington, where the examples of old glass which exist are very inconveniently placed for study. But it would be well worth the while of any first-rate firm, concerned in the manufacture, to put together such a collection, and to throw it open to architects. It would bring more business than an illustrated catalogue, and at a fraction of the cost.—*Building News.*

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* We are glad to note that the day has come when the architect is beginning to appreciate the fact that the advertisers who place their business in the architectural journals are not alone advertising their goods, but making it possible for the architectural profession and building trades to be represented by the highest class and most expensive journals of the country. A few mornings since we were in the office of a prominent architect who upon opening his mail immediately consigned all the circulars, etc., to the waste basket, saying in explanation of his action that he paid about two hundred dollars a year for architectural periodicals and from these he expected to keep fully informed on all matters of interest in his business. Continuing he said: "I have little use for the firm that will seek to bore us with tons of this sort of advertising matter, and cannot see how they can expect a busy architect to wade through such a mass of stuff when he can by reference to his papers gain the desired information." As the busy architect is the only one who has use for any amount of building materials there can be no advantage in going to the great expense of reaching the man who has no better employment than the reading of circulars.—*Northwestern Architect.*

MANUFACTURES AND MATERIALS

HYDRAULIC CEMENTS—NATURAL AND ARTIFICIAL.*

THERE are two classes of hydraulic cements with which we are all familiar, the artificial, or so-called Portland, and that produced from natural cement rock. All hydraulic cements, whether artificial or natural, are produced by a mixture of clay and carbonate of lime, or lime and magnesia.

In the manufacture of Portland cement in England, the clay is mostly selected from the river beds and the carbonate of lime from the chalk deposits which form a large portion of England's surface, and is a nearly pure carbonate of lime. Limestone is used wherever the chalk is unobtainable in some parts of England and Germany, and elsewhere, and is finely pulverized preparatory to its mixture with clay. These two ingredients are usually mixed together in a pug mill, with a free use of water. Sometimes, however, they are ground together in a comparatively dry state.

The material as it enters the kiln, whether it be an artificial mixture or a natural cement stone, is a mechanical combination of two chemical compounds, *i. e.*, silicate of alumina and carbonate of lime. The preliminary operation in calcination is the expulsion of moisture, which is soon followed by the carbonic acid contained in the carbonate of lime. The Portland cement manufacturer has it in his power to control the proportions of the materials he uses, and renders it possible for him to make his product uniform. Careful attention to proportions and mixing, and care in the matter of calcination, will produce a cement that seemingly leaves little to be desired. But so long as these details are entrusted to the hands of ordinary laborers—and there seems to be no other way—so long as the natural cements sustain their present reputations, and through their very cheapness keeping down the price of Portland, none but the cheapest class of labor can be employed in the manufacture of artificial cements, and no matter how vigilant the superintendent may be, there will be failures, and sometimes disastrous ones.

Henry Reid, in his admirable work on Portland cement, says: "Chalk and clay, being capable of easy solubility, are charged in their progress through the wash mill with three or four times their weight of water, and theoretically this process appears perfect, but practically, as we shall endeavor to show, there is considerable inconvenience, if not danger, even under the most careful supervision. The difference in the specific gravity of the chalk and clay involves an irregular deposition of the washed mixture, not only in its final settlement in the 'back', but on its way along the shoots. In the most limited works this objection exists, and in the largest in a more aggravated degree, for the farther from the wash mill the liquid material has to be propelled the greater must be the amount of its irregular and eccentric precipitation." Again he says: "The Portland cement maker has to reduce his raw materials to such a degree of fineness as will permit of their accurate combination, and this can be effected in two ways—the one chemical and the other mechanical. The former, the more expensive of the two, by converting the carbonate of lime into lime, and the silica into soluble silicates, and thus ensure an accurate result, but not one that a Portland cement maker can indulge in, and which we need not further discuss because of its costliness."

In speaking of the dry method, which is simply the mechanical reduction of the raw materials by means of suitable machinery, Mr. Reid says:

"When this is performed in a slovenly, careless or ignorant manner, much danger and expense arise. Doubtless this plan admits of no loose or 'rule of thumb' treatment. Chemically, the lines laid down must be implicitly adhered to, and mechanically, the reduction of the ingredients should be as nearly perfect as possible. There is a danger attending this method, which is sometimes a puzzle to the ignorant, and that is, the want of proper care in applying the necessary moisture to render the mass plastic enough for moulding into bricks (preparatory to calcination). If the water is carelessly thrown on, as is the case in tempering clay for brick making, there is a liability to separate the atoms of carbonate of lime from those of the silicate of alumina, and thus destroy the necessary accuracy of combination so essential to an effective kiln result."

Now here are the two methods employed in the manufacture of Portland cements, the wet method and the dry, and we have shown that both are attended with a danger that must ever be constant, so long as the matter of communition is entrusted to human hands.

While nature did not always deposit her natural cement rock formations in true combining proportions, no handicraft has ever yet excelled or even approached her in the art of mechanical combinations of clay and carbonate of lime, for with natural cements, however much the proportions of ingredients may vary as between the upper and lower layers, there is usually a large percentage of the bed that is so well proportioned as to yield a good cement when all are mixed together. And even the layers that are not properly proportioned, owing to their finely commingled condition, are not as dangerous an element in the mass as is that of an equal amount of an imperfect mixture in an artificial cement. There was imported into this country during the past year about 600,000 barrels of Portland cement, and it is safe to assume that there were not more than 15 analysis made from this enormous amount. That is one analysis for every 40,000 barrels, and, so far as I have been able to learn, no two of these are found to agree.

Furthermore, it is possible to adulterate Portland cements, and, if we are to believe the printed reports of the transactions of the association of Ger-

*Extracts from a Paper read before the Society of Arts of the Massachusetts Institute of Technology, Boston, Mass., by Mr. W. Cummings, of Buffalo, N. Y.