

products by capillary action. By this method the color is deposited into the pores of the surface, amalgamating with the concrete into a permanent unit. The possibilities of this treatment are unlimited if based on knowledge of coloring values and good judgment not to impair the strength requirements of concrete. Coloring solution can be made to penetrate the surface of concrete six inches or more, if the object is immersed while in a very green state, but it is rarely necessary to penetrate more than one-thirty-second to one-eighth of an inch; this thoroughly fills all pores, gives the desired color effects and is less expensive. Every atom of coloring absorbed by the concrete reduces the strength of the solution; and as some of the coloring matter used is quite expensive, good judgment to allow only the necessary absorption of coloring matter is advisable from an economic standpoint. The sulphates of copper and iron are the most suitable to make solutions to color concrete by the capillary method.

Concrete can be so treated after it is a week old. When used in construction and carrying loads it should not be subjected to the coloring bath until the concrete has attained its required strength, as the filling of the pores in the concrete retards the action of hardening. Coloring by absorption is effective on concrete after it comes out of the mold or after being treated with tools. Surfaces that have been colored by absorbing mineral or metallic colors become more weatherproof and the action of the weather on the metallic colors increasing the beauty of coloring by the usual oxidation noticed on bronze and copper. Concrete treated by this method becomes so hard and dense that it will take a polish. I have treated its surfaces in the same manner as marble, granite and metal under polishing or buffing machines.

Wet cast concrete products, such as flower pots, vases and boxes, will hold water after the second day of casting and become so hard that when struck with a hammer they ring like a metal bell; waterproofing compound helps, but is not essential to obtain this result. I consider that the thorough mixing of the proper amount of cement and water with graded aggregates is all-important. Extensive tests made during the past three years with commercial waterproof paints produced excellent results. Common concrete can be made very attractive by one or two coats, and applied in stipple fashion, it will not impair the grain or texture, avoiding the undesirable appearance of brush-painted stone. This method is especially to be recommended for dry or semi-dry tamped concrete work, the porous surface readily absorbs the waterproof liquid and thereby allows the pigment particles to fill the pores.

By using spraying machine the color effect is

obtained most economically. It gives a uniform color or can be varied to give the richness and depth of shading that results from this treatment in experienced hands. It can be applied where immersion is not practicable. I have obtained two and three color effects by painting certain parts of an object before subjecting same to the coloring bath. The parts so colored would not be affected by the color in the bath, the absorptive quality having been neutralized.

The artistic possibilities of such treatment are only limited by the color sense and taste of the craftsman. Using certain non-absorptive aggregates their natural color can be retained, while the absorptive parts, especially the cement mortar will assume the desired color. Precaution must be taken in the use of acid washing before immersion in the color bath as the chemical action of the acids is liable to counteract the color values of the bath. Acid should not be employed after concrete is treated with colors.

Long practice and tests will give the full benefit of this process.

In the matter of surface finishes, considerable headway has been made and most of the methods are well known to the progressive concrete man. Many are so simple and inexpensive that concrete need not remain unattractive to the architect.

Most of our trim stone and ornamental work is wet cast, it is required to stay in the mold from twenty-four to forty-eight hours, and we use a four per cent. solution of calcium chloride for our mixing water; during cold weather our shops are steam heated and kept at a temperature of seventy degrees.

We do not use curing rooms, but for quick hardening use high pressure steam cylinders six feet in diameter and seventy feet long. We have commercially verified the tests made some years ago by the U.S. Bureau of Standards and reported in Technologic Paper No. 5.

While these tests did not exceed eighty pounds pressure, we have hardened concrete with one hundred and fifty pounds steam pressure, obtaining results so that concrete two days old could be tooled under rapidly revolving carborundum wheels, cutting flint aggregates without pulling out or fraying the edges. The mixtures used were from one to ten to one to five. Compression tests showed over four thousand pounds in two days and absorption less than five per cent. The higher the steam pressure the less time it requires to harden. With one hundred and fifty pounds we reduced the time to four hours, besides the two to three hours it requires to bring the pressure up to one hundred and fifty pounds. Concrete so hardened has been subjected to weathering for

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