Patented July 3, 1945

2,379,502

UNITED STATES PATENT OFFICE

2,379,502

PROCESS FOR STAINING CONCRETE

Ernest H. Swift, Pasadena, Calif.

No Drawing. Application August 10, 1942, Serial No. 454,296

5 Claims. (Cl. 117—123)

This invention relates to a process of and means for staining concrete.

The object of my invention is to provide a process of and means for staining concrete without a preliminary acid treatment to the surface of the concrete.

Another object of my invention is to provide a simplified process and means for staining concrete in which the cost of the process is very economical, in which the intensity of the color is increased, and in which the staining chemicals penetrate more deeply into the surface, thus producing a more durable stain.

Another object of my invention is to provide a process of staining concrete in which the staining solution is buffered to a pH of definite value in order to obtain uniformity of color with a concrete surface which may vary in alkalinity.

Other objects and advantages of my invention will be evident from the examples of my invention set forth hereinafter.

Heretofore it has been common practice to employ the metallic sulfates in preparing solutions for the staining of concrete surfaces; cupric sulfate, manganous sulfate, ferrous sulfate, also ferric, aluminum and chrome alums have been commonly specified. These salts have been used because of their cheapness and commercial availability. However, sulfates have certain undesirable features. It is desirable that the solutions used for the staining process be quite concentrated (in order to secure better penetration and intensity of the stain). However, the sulfates in general are not as soluble as are certain other salts, such as the chlorides, nitrates and acetates. Also, the limited solubility of the sulfates has made it necessary to mix the solutions at the location of the staining operation in order to avoid transporting large volumes of such solutions. Finally, the sulfate radicle, or anion, has the undesirable property of forming insoluble calcium sulfate with the calcium cation. The formation of this insoluble calcium sulfate has heretofore caused two defects in the chemical staining of concrete surfaces. First, the excess of lime in and on the surface of concrete structures, has caused it to be necessary to make a preliminary treatment of the surface of the concrete to be stained with an acid, such as a dilute solution of hydrochloric acid, in order to dissolve and remove this lime and thus to avoid the formation of an excessive amount of an adherent surface film of calcium sulfate. Secondly, the formation of insoluble calcium sulfate in the surface layers of the concrete has prevented the penetration of the staining chemicals into the concrete to produce the permanent and durable stains as is desired.

I have found that if the staining solutions are composed of compounds containing only those anions which form, with the constituents of the solution, salts which are extremely soluble in water, and if, furthermore, these solutions contain only anions which form very soluble salts with calcium, for examples, chlorides, acetates, or nitrates, the process of applying the stain can be much simplified, the cost of the process materially reduced, the intensity of the color can be increased, and the staining chemicals caused to penetrate more deeply into the surface thus producing a more durable stain. In fact, the simplification of the process resulting from the use of such solutions now makes it possible to sell such solutions to the untrained layman and for such layman to successfully apply the stain without previous training in the art. Thus with such solutions it is now possible to obtain by a simple application of the solution to the surface of the concrete a more intense stain than was heretofore obtained by the use of a preliminary acid treatment followed by three successive applications of the former staining solutions.

As an example, I have found that a solution of the following proportions by weight produces a penetrating and intense reddish brown color on concrete:

	Parts
Ferric chloride	2
Ammonium chloride	1
Water	5

The surface of the concrete to be stained is first cleaned, after which the staining solution may be applied directly to the surface by means of a brush or a spray gun, or by simply flooding the surface of the concrete with the solution, without any preliminary acid treatment whatever. In connection with the above example, I have produced satisfactory stains by using 3.3 pounds of solution per 100 square feet, although more or less of the solution may be used depending upon the intensity and penetration desired and upon the composition, texture, and age of the concrete to be stained.

Although a stain can be produced by a solution consisting of 2 parts of ferric chloride and 5 parts of water, the results are not entirely satisfactory for several reasons. The addition of the ammonium chloride increases the penetration and intensity of the stain. This effect is to

be attributed to the fact that ferric chloride forms with an excess of chloride ion the complex tetrachlorferriate anion, thus decreasing the hydrolysis and increasing the solubility of the ferric chloride and permitting a deeper penetration of the concrete before decomposition to the hydrous oxide takes place.

I have found that a solution of the following proportions by weight produces a penetrating and dark brown stain on concrete:

Chromic nitrate	2
Sodium dichromate	1
Water	6

and that a pleasing greenish tan color can be obtained by the use of a solution of the following proportions by weight:

Chromic nitrate	6
Sodium chromate	3
Acetic acid (glacial)	1
Sodium acetate	3
Water	15

The sodium acetate and acetic acid are advantageously used where it is desired to buffer the solution to a pH of definite value and thus obtain uniformity of color with a concrete surface which varies in its alkalinity.

These solutions are applied in the same manner and in approximately the same amounts as set forth above in connection with the ferric chloride solution.

From the foregoing description, the uses, advantages, and operation of my invention will be readily understood by those skilled in the art to which the invention appertains. While I have described certain examples of my invention, I desire to have it understood that the examples given are merely illustrative, and that the invention is not to be limited to the details disclosed herein, but is to be accorded the full scope of the appended claims.

I claim:

1. The process of staining concrete without a preliminary acid treatment to the surface of the concrete which comprises applying a concentrated solution of the staining chemicals directly to the surface of the concrete, said chemicals containing as anions only those radicals capable of forming soluble calcium salts, and containing sodium acetate and acetic acid to buffer the solution to compensate for variations in alkalinity of the surface of the concrete in order to obtain uniformity of color with a concrete surface which varies in its alkalinity.

2. The process of staining concrete without a preliminary acid treatment to the surface of the concrete which comprises applying a concentrated solution of staining chemicals which act by depositing metallic oxide directly to the surface of the concrete, said chemicals containing as anions only those radicals capable of forming soluble calcium salts, and containing an acid and a salt of that acid to buffer the solution in order to obtain uniformity of color with a concrete surface which varies in its alkalinity.

3. In a single step process for staining concrete having a film of calcium salt thereon, the improvement comprising applying directly to the concrete surface a concentrated solution of an iron salt containing as anions only those radicals which form calcium salts that are extremely soluble in water, and containing an acid and a salt of that acid to buffer the solution in order to obtain uniformity of color with a concrete surface which varies in its alkalinity.

4. The single step process of staining concrete without a preliminary acid treatment of the surface of the concrete, which comprises applying directly to the surface of the concrete, a concentrated solution of a manganese salt containing as anions only those radicals which form calcium salts which are soluble in water, and containing an acid and a salt of that acid to buffer the solution so as to obtain uniformity of color with a concrete surface which varies in its alkalinity.

5. In a single step process of staining concrete without preliminary acid treatment of the same, the improvement comprising applying directly to the untreated concrete surface a concentrated solution of a copper salt containing as anions only those radicals which form calcium salts that are soluble in water, and containing an acid and a salt of that acid to buffer the solution and obtain uniformity of color on a concrete surface which varies in its alkalinity at different points.

ERNEST H. SWIFT.