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UNITED STATES PATENT OFFICE.

GEORGE B. HINTON, OF MEXICO, MEXICO.

PROCESS OF MAKING CEMENTITIOUS MATERIAL OF CELLULAR STRUCTURE.

No Drawing. Application filed September 19, 1927. Serial No. 220,643.

This invention relates to a process for making a cementitious material of cellular texture, by introducing air by agitation or other means into a pulp of hydraulic cement and water to which has been added a small quantity of a frothing flotation reagent. This application is a continuation in part of my application Serial No. 165,494, filed Feb. 2, 1927.

The material made in accordance with the present invention is essentially a form of concrete of cellular texture, that is impermeable to the passage of liquids. The process resembles the flotation process known in the art of separating minerals, in that a certain kind of oil, called a "flotation oil", is used to induce the adherence of a film of air to a grain of a solid, but the present invention is different from the flotation process in that I use the properties of a flotation oil not to separate minerals but to coat bubbles of air with cement.

Air, cement, and water will not mix together. If a cement pulp be beaten up with air, most of the air will separate from the pulp as soon as the beating stops. But if a cement pulp be beaten up with air and a trace of a flotation oil, an extraordinary change takes place. The bubble formation is accelerated and stabilized. Air is found to be completely miscible with cement pulp in the presence of a minute quantity of a flotation oil. This is my discovery and the use of this principle to make cementitious materials of cellular texture is the subject of this patent application. My meaning of the term "flotation oil" will be hereinafter defined exactly.

The proportion of air to cement in my product depends largely upon the proportion of water to cement in the cement pulp or grout with which the flotation oil is agitated. Cement grouts with less than 30% water by weight are unworkable. Grouts with over 60% of water by weight produce cementitious materials of too light weight to be generally useful.

For carrying out the process I find that a mechanically operated flotation machine for separating minerals from their ores may be used.

In the operation of the process cement is mixed with from 30% to 60% of water or preferably with this proportion of water that has been already saturated with cement. A small quantity of a flotation oil is added. This cement pulp is then conditioned by agitation for a short time and then put into the flotation apparatus.

Any reagent known in commerce as "flotation oil" will give a result, but some of these flotation oils give better results than others. Of the flotation reagents that have been tried the following give the best results:

Pine oil especially when mixed with a heavy collecting oil such as petroleum or coal tar.

Phospo-cresylic acid (aero-float reagent).

Oleic acid (red oil).

Sodium resinate. ← (disclaimed)

The total quantity of oil or mixture of oils does not exceed 0.2% of the dry weight of the cement.

The term "flotation oil", including collecting oils and frothing oils, is well known in the art of metallurgy where oils are used in the flotation process for separating minerals from their ores. Whereas the oils used in the flotation process embrace many reagents of different chemical nature, yet their common property of inducing the attachment of a film of air to a grain of a solid, brings them together under the classification of "flotation oils".

This process for the manufacture of a cementitious material of a cellular texture resembles the flotation process in that an oil is used to form a froth. The action of oil in forming a froth is the basic reaction of the flotation process as developed in the art of separating minerals from their ores.

The basic reaction of the flotation process consists in the attachment of a bubble of air to a grain of a solid by means of a film of oil. The simple phenomenon is that the oil sticks to the solid and the air sticks to the oil; therefore, if a minute quantity of oil be added to a pulp of water and ground solid and the whole be aerated and agitated, the grains of solid will be coated with a film of oil and to this film of oil bubbles of air will be attached or adsorbed, and grains of solid will be embedded in the film of oil that encloses each bubble of air. The reagents referred to herein as flotation oils are those that when used as described, result in the

basic reaction of the flotation process as set forth above.

These reagents well known in the art as flotation oils belong chiefly to the following chemical groups:

Coal tar and petroleum and derivatives of these.

The oily products of the distillation of vegetable matter.

Oily organic acids.

A froth produced by the basic reaction of the flotation process as described has characteristics that differentiate it from froths made by other than this reaction.

The flotation reaction requires only a very small quantity of flotation oil to make a froth, less than 0.2% of the dry weight of the solid.

The flotation reaction is a molecular surface tension reaction between the oil, water, air and solid.

The durability of a flotation froth of cement does not depend in any way on the mechanical strength or stickiness of the oil, for with a given minimum quantity of flotation oil sufficient to film the grains of cement the mechanical properties of the froth are independent of the quantity of oil added within wide limits.

The adherence of the reagent to a particle of solid matter and of the air to the reagent is a molecular surface tension reaction. Under these conditions, the minute bubbles of air coalesce under the influence of surface tension and each bubble of air will be enclosed in the film in which are embedded the grains of the solid material. Thus it will be seen that the presence of a flotation reagent in an aerated cement pulp produces cement coated bubbles of air. The stability of a froth of cement produced by the flotation process is attributable to the inter-reaction of the air, water, oil and cement.

In order to reduce the cost of the product, a filler such as sand or other inert material may be added to the cement pulp.

Having set forth a preferred embodiment of my invention, I claim:

1. The process of making a cementitious material which comprises forming a pulp of hydraulic cement, water and a frothing flotation reagent, and agitating the pulp to a froth.

2. The process of making a cementitious material which comprises aerating a pulp composed of hydraulic cement, water and a relatively small amount of a frothing flotation reagent to produce a relatively stable froth.

3. The process of making a cementitious material of cellular structure which comprises preparing a mixture of hydraulic cement and water, adding thereto a relatively small quantity of a frothing flotation reagent, and agitating and aerating the pulp to a frothy consistency.

4. The process of making a cementitious material which comprises forming a pulp of hydraulic cement, water, inert filler and a frothing flotation reagent, and agitating the pulp to a froth.

5. The process of making a cementitious material which comprises preparing a mixture of hydraulic cement, water, and an inert filler, adding thereto a relatively small quantity of a frothing flotation reagent, and agitating and aerating the pulp to a frothy consistency.

Signed at Mexico, D. F., this tenth day of September, 1927.

GEO. B. HINTON.

DISCLAIMER.

1,657,716.—*George B. Hinton*, Mexico, Mexico. PROCESS OF MAKING CEMENTITIOUS MATERIAL OF CELLULAR STRUCTURE. Patent dated January 31, 1928. Disclaimer filed August 1, 1928, by the patentee.

Hereby enters this disclaimer to that part of the specification which is in the following words, to wit: "sodium resinate" occurring in line 70 of page 1 of the specification.

[*Official Gazette August 21, 1928.*]