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METHOD OF MAKING A HARD SURFACED CEMENT

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6 Claims. (Cl. 106—24)

The present invention relates to improvements in the manufacture of ground iron and to an improved ground iron particularly useful as a surfacing ingredient to give wearing qualities to concrete and cement.

It has been a practice for some time to add ground iron of suitable fineness to cement or concrete so that the wearing surface has the iron embedded and exposed in large part. In itself this is not novel nor any part of the present invention. In the common practice of carrying out this idea a certain difficulty has been encountered which has seriously limited the extent to which the ground iron is so employed. The chief difficulty has been the formation of bubbles where the ground metal contacts the cement body. This of course makes a poor surface, and in addition causes the iron particles to be loose or more easily loosened and eventually removed. This in turn makes holes in the surface with thin webs of cement bond, which are more easily broken. While in principle the idea should improve the wearing surface, it may and has frequently impaired the surface for some unknown cause.

The uncertainty of result in this field heretofore encountered has deterred many from employing ground iron in this way. I have made an investigation of the problem, have ascertained the cause, and have overcome the difficulty, so that the uncertainty is eliminated.

I have discovered that certain non-ferrous materials, such as metals, in the ground iron are reactive with the alkali of the cement to form the undesired gas bubbles. Not all non-ferrous metals act this way. My invention comprises treating the ground iron with alkali before its use in cement, so that the gas-forming non-ferrous metals or materials may exert their gas-forming function in advance. It is immaterial what the metals or other gas-forming materials are, but I do know that aluminum is a common and a predominant non-ferrous impurity which has caused much trouble heretofore.

The primary object then of the present invention is to treat commercial ground iron with alkali until the gas-formers therein are practically spent.

A particular object of the invention is the treatment of commercial ground iron with caustic soda.

Another object is the provision of ground iron coated or admixed with residual alkaline material, whereby it is protected against corrosion prior to its use in concrete or the like.

Various other and ancillary objects and advantages of the invention will appear from the following description and explanation of the invention as I prefer to practice it.

In considering the merits of this invention it must be fully appreciated that economies and commercial specifications dictate low prices. For this reason a certified iron is not available for conversion into ground iron. Waste iron or scrap is employed commercially, and is reduced by suitable grinders to a fine state. A fineness such that the iron passes a mesh of 14 to 20 and resides on a mesh of 40 to 60 is suitable, but these are by no means limitations to the size.

It is because scrap iron has been used that non-ferrous gas forming ingredients, such as aluminum or zinc, have been heretofore ground up with the iron. Because of the treatment directed by this invention such scrap may be used with impunity, and a large quantity of aluminum, zinc, or the like may be knowingly permitted in the raw material to be ground.

The raw iron which I employ may be in the form of chips or turnings from machining operations, galvanized scrap, or sheet metal scrap picked up in miscellaneous quarters. It not only may contain aluminum and zinc, but it may carry considerable oil. Oil in the ground iron may prevent some particles from being wetted by wet cement and consequently such particles may not be firmly anchored in the set cement. By reason of the treatment of the ground iron with alkali as herein described, the alkali removes the oil and grease. The action of alkali in forming gas in the process, especially in a bath treatment, easily effects emulsification of the oil and grease. As a result, the iron is not only free from gas-formers but it is free from grease and oil.

The iron scrap after grinding, with or without a subsequent classification, may be subjected to the action of an alkaline solution. Calcium hydroxide may be used, as this is practically identical with the active alkali in the wet cement. A sodium carbonate may be used. I prefer to use a caustic alkali such as caustic soda for various reasons.

The alkali solution may be hot or cold, the cooler solution requiring a longer time for gas-formation to be completed. The concentration may vary over a wide range. For example, 10% solution up to a 30% solution of caustic soda is satisfactory. Much more dilute solutions may be used, but it is more practical to use a stronger hot solution in order to speed up the procedure. The solution may be poured over and through the

iron, or the iron may be moved through the solution, as in a counter current system, or the batch process may be used, immersing the iron in a bath of solution.

After the treatment is completed I prefer not to remove excess alkali solution, because I take advantage of the residual adherent alkali. For this reason I prefer to use a quite strong alkali originally of 10% to 30% caustic soda. The alkali-wet iron is then dried preferably with heat, in order to coat the iron with the dry alkali. In practice, I run the wet material through a rotary drum drier in contact with heat, flame, or combustion gases. These may be waste gases, or a specially created flame may be used. The iron is thus dried and heated. I prefer an oil or gas flame in order to burn away any organic matter which may be present.

Where caustic soda is used, and combustion gases are present in the drier, all or a considerable part of the caustic soda may be converted to a sodium carbonate. Either the dry caustic or carbonate coating on the iron particles is effective protection against rusting or corrosion while in transit or storage. Ordinarily it is stored or shipped in bags.

The small amount of alkali thus present on the iron is not at all detrimental to the cement when the dry coated iron is added to cement. If desired for any reason a simple leaching with water, prior to incorporation into cement, may be carried out in order to remove a part or all of the adherent protective alkali. Depending upon the character of the alkali, it may be found that the alkali speeds up the setting of the cement and more quickly and firmly binds the iron dust. A lime alkali of course would not have such pronounced setting action as does the sodium alkali above described. The quicker setting tends to prevent the heavy iron particles from sinking in the wet plastic mass as it sets.

In use the material is reliable in being free from a tendency to gasify in the cement, and in being easily wetted by the cement. Thus, use of the so-treated iron assures that a reliable and improved wearing surface on concrete, can be secured and retained.

Although I have described the alkali treatment as following the grinding for the advantages appearing above, I also contemplate that the scrap iron before grinding may be treated with alkali for the same purpose. Accordingly the preferred process herein described is not to be considered as limiting the invention.

In the accompanying claims I use the term "Portland cement", and by it I refer to any hydraulic cement which by nature has reactive substance therein capable of causing non-ferrous materials, such as aluminum, as an impurity in ground iron, to form a gas, without causing iron to form gas.

Certain modifications of the described procedure are permitted and many such departures therefrom are contemplated as following within the scope of the invention as set forth in the appended claims.

I claim:

1. The method of making permanent hard surfaced Portland cement, which comprises grinding a mass of iron material likely to contain certain impurities capable of forming gas when present in wet Portland cement, treating the ground mass directly to an alkali solution whereby said gas-forming impurities therein are decreased in quantity, drying the so-treated mass while wet with alkali whereby to coat the particles with a protective alkali, and adding the treated iron to Portland cement.

2. The method of making permanent hard surfaced Portland cement which comprises grinding a mass of scrap iron, treating the ground mass with an alkali solution whereby to destroy gas-forming material therein which is active in the presence of alkali, and incorporating the alkali-treated ground iron from the mass into Portland cement.

3. The method of making permanent hard surfaced cement or concrete of Portland cement base which comprises grinding a mass of commercial scrap iron to a pulverulent form, subjecting the ground mass directly to the action of alkali solution capable of gas-forming reaction upon impurities of the ground iron which are characterized by the property of forming gas in wet Portland cement, drying the so-treated ground mass, and adding the dry mass to Portland cement.

4. The method of making permanent hard surfaced cement or concrete of Portland cement base which comprises grinding a mass of commercial scrap iron to a pulverulent form, subjecting the ground mass directly to the action of alkali solution capable of gas-forming reaction upon possible impurities in the ground mass which are characterized by the property of forming gas in wet Portland cement, heating the so-treated ground mass whereby to burn away combustible matter therein, and adding the resulting mass to Portland cement.

5. The method of making a hard surfaced concrete or cement mass by adding iron-base particles to a mixture of Portland cement base, characterized by a preliminary treatment of the iron-base particles to be added with a solution of an alkaline reagent until any gas-forming tendency with alkali is expended.

6. The method of making a hard surfaced concrete or cement mass by adding iron-base particles to a mixture of Portland cement base, characterized by a preliminary treatment of the iron-base particles to be added with a solution of an alkaline reagent until any gas-forming tendency with alkali is expended, and drying the iron-base particles with residue of the alkaline solution as a coating on the particles, whereby said coating protects the iron particles from corrosion, and whereby said coating becomes effective in the setting of the Portland cement.

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