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COOLING OFF OF SAND AND GRAVELS

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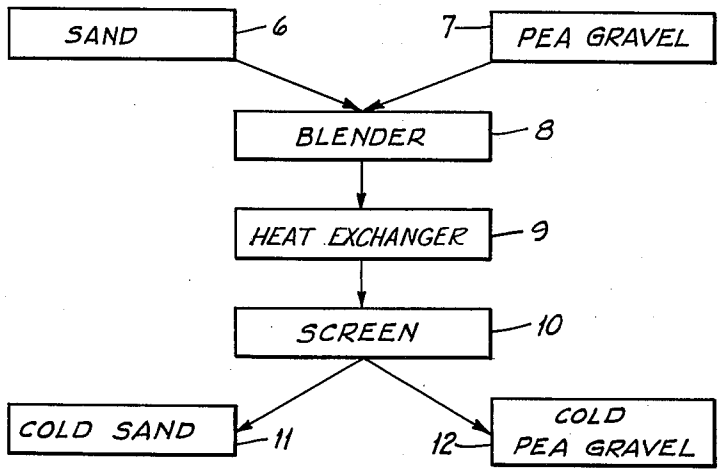

Fig. 1

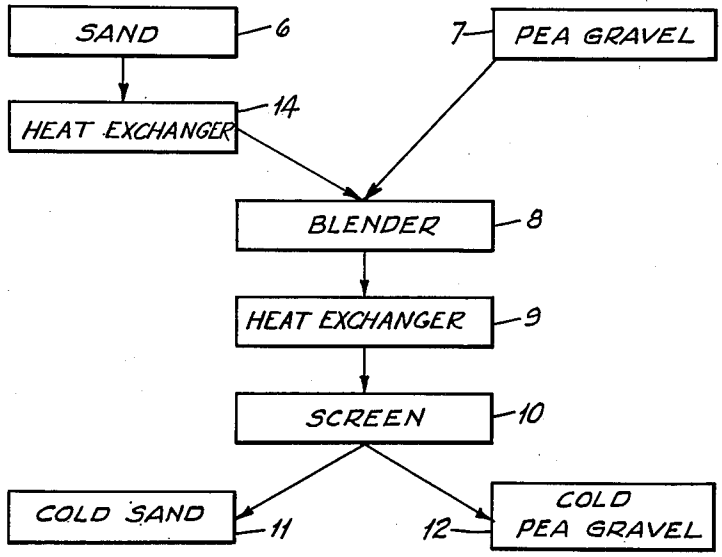

Fig. 2

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COOLING OFF OF SAND AND GRAVEL

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4 Claims. (Cl. 62—170)

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This invention relates to the preparation of pea gravel and sand for use in the manufacture of large, massive structures of concrete.

It has long been recognized that large concrete structures, such as dams, are subject to cracking if the temperature of the mass increases appreciably during setting of the cement. To ensure this will not occur, various steps have been taken such as actual inclusion in the structures of conduits for circulation of cooling fluids. In addition, the cooling of the coarse aggregate utilized in such concrete structures has long been practiced; coarse aggregate comprises the rock from 6'' to ¾'' size. Such coarse material can be cooled by flooding with cold water and then draining, or by circulating cold air over the rock mass. Concrete, however, in addition to the aforementioned aggregate, includes pea gravel, and, cement and water. It has not been feasible to cool the pea gravel and sand heretofore inasmuch as each offers too great a resistance to the flow of the air while inundation with cold water is not suitable inasmuch as the pea gravel must be drained to enable adequate moisture control to be maintained and the water properly proportioned in the resulting mix. When inundation is attempted upon pea gravel, by the time the pea gravel has drained adequately, it will have attained a normal atmospheric temperature so that the effect of cooling is completely lost. Similarly, inundation with cold water is impractical upon sand, the inundation floating off too many of the fines from the sand; in addition, it must be drained.

I have found that the pea gravel and sand can be suitably cooled by mixing the two together, cooling the resulting mass by indirect contact with a refrigerating or cooling fluid and subsequently separating the two materials so that they can later be accurately proportioned for the concrete mix. It is not necessary initially to mix the pea gravel and sand and one can utilize instead a natural material or even artifically produced but which can be subsequently sized to provide the pea gravel and sand components. Pea gravel as such cannot be cooled efficiently because of its granular nature which provides a considerable volume of voids. By adding said to the pea gravel, the voids are filled and efficient cooling achieved.

It is in general the broad object of the present invention to provide a novel method of cooling pea gravel and sand for use as in concrete manufacture.

Another object of the present invention is to

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provide a novel apparatus for cooling of pea gravel and sand.

The invention includes other objects and features of advantage, some of which, together with the foregoing, will appear hereinafter wherein the present preferred form of method and apparatus embodying this invention are disclosed.

In the drawings accompanying and forming a part hereof, Figure 1 and Figure 2 are, respectively, diagrammatic illustrations of apparatus and process steps utilized in practicing the present invention.

Referring particularly to Figure 1, I have indicated a stock pile of sand 6 and a stock pile of pea gravel 7 as sources of suitable materials. These are delivered continuously and at a substantially uniform rate into a blender or mixer 8, the latter being preferably cooled. Thereafter, the resulting homogeneous mixture of pea gravel and sand is passed through a cooler generally indicated at 9 such as the heat exchange-screw conveyor structure disclosed in my Patent 2,321,185; one can also utilize other structures such as one wherein two or more of such heat-exchange conveyors are provided rotating in opposite directions in a suitable casing which is also cooled, the flights rotating about parallel axes with the flight on one in almost wiping contact with the supporting hollow shaft of the other flight. One can also use four or six such flights arranged in a side-by-side relation with any two adjoining flights in such near-wiping contact. Such flights can be utilized in tiers to provide the heat abstraction required.

From the cooler 9, the cooled mass is delivered to a screen 10 whereon it is separated into sand and pea gravel, these being delivered to the stock piles 11 and 12.

In Figure 2, I have illustrated another form of practicing the invention wherein sand and pea gravel from the stock piles 6 and 7 are utilized. However, in this case, the sand from stock pile 6 is passed through a preliminary cooler 14 wherein it is separately cooled and after which it is passed to the blender 8, to which the pea gravel is also delivered from stock pile 7. The mixture from the blender 8 is then passed through the cooler 9 and thereafter the cooled mixture is passed over screen 10 to separate the pea gravel from the sand.

By mixing the pea gravel and sand, the voids in the pea gravel are filled adequately so that an efficient cooling is practical upon the pea gravel whereby the mixture is cooled rapidly and effectively. In addition, attrition which occurs

upon the pea gravel during the several steps does not affect the quality of the pea gravel adversely inasmuch as any fines created and which are suitable for inclusion in the cold pea gravel fraction are included in the cold sand fraction; pea gravel is defined herein and in the claims as generally including that material passing a ¾ mesh screen and which is retained upon a 4 mesh screen, while sand is defined herein and in the claims as generally including that material passing a 4 mesh screen and which is usually all retained on a 100 mesh screen.

In a typical operating example, pea gravel and sand were utilized, the temperature of each being 92° F. The sand was passed through a first cooler 14 wherein it was cooled at 65° F., thereafter being mixed with the 92° F. pea gravel in blender 8 wherein the mass was further cooled with the result that the temperature of the material issuing from the blender was 65° F. Thereafter, the homogenous mass was passed through the second cooler wherein the temperature of the mass was lowered to 45° F. The two materials were then passed over the screen 10 wherein they were separated into a cold pea gravel fraction and cold sand fraction, each ready for utilization immediately in the concrete manufacturing operation.

Sand usually comprises about one-fourth the aggregate volume and pea gravel about an eighth. By cooling these, one is about to cool a very substantial volume of the solids utilized. The invention is not limited to sand and pea gravel fractions for the larger aggregate can be included as well if this be desired, but not to exclusion of the sand and pea gravel fractions.

I claim:

1. A process for pre-cooling concrete constituents comprising mixing a pea gravel fraction and a sand fraction to provide a homogeneous mass, cooling said mass to a desired temperature by passing the mass over a cooled heat exchange surface, and separating the cold pea gravel fraction from the cold sand fraction.

2. A process for pre-cooling concrete constituents comprising cooling a sand fraction, mixing a pea gravel fraction and the so-cooled sand fraction to provide a homogeneous mass, cooling said mass to a desired temperature by passing the mass over a cooled heat exchange surface and separating the cold pea gravel fraction from the cold sand fraction.

3. In the preparation of concrete fractions, the steps of cooling a mass, including a pea gravel fraction and a sand fraction, to a desired temperature by passing the mass over a cooled heat exchange surface whereat such fractions are useful in concrete and thereafter separating the mass to provide a separate cold pea gravel fraction and a separate sand fraction.

4. A process for pre-cooling concrete constituents comprising mixing a pea gravel fraction and a sand fraction to provide a homogeneous mass, cooling said mass to a desired temperature by passing the mass through a cooled heat exchange screw conveyor, and separating the cold pea gravel fraction from the cold sand fraction.

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