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AGGLOMERATING MIXTURES OF SOLID MATERIAL AND LIQUID

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A method is known by which it is possible to increase the compactness and, therefore, the tensile strength and/or the resistance to compression of certain agglomerated bodies, which consists in submitting the mixture of the substances which must finally form the agglomerated body to a vibratory action of the order, for instance, of 3,000 to 6,000 vibrations per minute. This vibratory action is transmitted to the said mixture before the agglomeration is achieved or even before it is practically started. Generally the vibratory action gives better results when the vibratory movement has a direction which is parallel to the direction of the force which would tend to shift the said substances if the latter were free in the space. This vibratory action is imparted to the substance or substances to be treated by means of vibrating devices such as, for instance, electrical devices which are unbalanced or provided with excentrical means and which are secured to the vessel containing the said substance or substances or, still better, by placing the said vessel on a vibrating table.

Thus, for instance, by causing vibrations to act in a vertical direction on a mixture of pebbles, sand, cement and water, adapted to form a concrete after binding, one succeeds in doubling the mechanical resistance of the said concrete. The vibrations which are imparted to the mass of the mixture are transmitted to the substances which form the latter and cause them to slide against each other so that water rises to the surface and so the pebbles and the sand corns take a directional position and slide against each other so as to diminish the volume of the spaces comprised between them and to remove the air contained therein, the said spaces being more completely filled with cement and water than if no vibratory action were imparted to the mixture. In spite of the remarkable results obtained by the said method it would still be desirable in most cases of the practice to increase the resistance of concrete.

In a like manner, in the manufacture of artificial teeth from porcelain powder which is then submitted to a burning operation resulting in a more or less complete fusion, the use of a vibratory action has for its effect to insure a mutual granular arrangement of the corns of the mixture of porcelain powder and water which is used, the spaces between the corns being then less numerous and smaller than if no vibratory action had been imparted to the mass.

It is also known how difficult and expensive it is to agglomerate or even only to dry solid material in a colloidal state in a liquid excipient or vehicle. This is the case, for instance, for peat and also for the sludge or slamms encountered as waste of manufacturing operations in considerable quantities which the economical conditions do not permit to agglomerate with advantage. If it were possible, through a simple and unexpensive method, to free the said materials from an important portion of the water they contain the agglomeration of the same would be greatly facilitated and this would more particularly increase the value of the said materials. Now, in the case of peat freshly extracted from the moors and containing, as well inside as outside the cells which form the same, a proportion of water which can reach a total amount of 90% of the weight of its global mass, the use of powerful hydraulic presses and of certain filtering devices allows at the best to reduce this proportion to 50% the water of the cells being not expelled. Nor does the imparting of a vibratory action to the said materials permit to lead by itself to the desired result.

In the like manner, the agglomeration of still other materials which are mixed with a liquid or a liquid solution in order to obtain a mouldable or slubbable paste would be rendered more advantageous and the obtained products would be of a better quality if the proportion of liquid or solution as, for instance, water or a solution of sodium silicate, or dextrin, molasse, a product of the hydrolysis of cellulosic material, gum, sugar, protein, glue, natural or synthetic rosin which is used for forming the paste to be moulded or slubbed were diminished and, simultaneously, if the mutual granular ararngement of the grains to be agglomerated were facilitated during the operation of imparting a vibratory action to the same.

The present invention has for its object a method which permits of obtaining this result in all the cases where it is desired to form an agglomerate body, while imparting a vibratory action, with a solid material in the form of grains, even if the latter are mixed with water in the form of a dispersion or an emulsion or even if they are totally or partially in a colloidal state, as this is the case, for instance for peat, sludge, residue of wine manufacture, of sugar-mills or sucrate-works.

The process according to the invention facilitates the agglomeration of the material of the above defined kind and permits to obtain agglomerated bodies which are more compact, more dense, less porous and have an increased me-

chanical resistance for the same power of the agglomerating devices. It offers the possibility of reducing the proportion of water which is used and, consequently, the volume of the mixing devices, the weight of the substances to be conveyed to the moulding devices, the space occupied by the latter and their power for the same final density of the agglomerated bodies. In the case of material in the state of colloidal suspension as, for instance, peat, the said method insures the evacuation of a large proportion not only of the water serving as an excipient, but also of the water contained in the cells themselves. In every case, it permits of reducing the period of time for imparting the vibratory action necessary for obtaining the same granular arrangement of the treated material or materials as when the process is not applied to, or for the same duration of the vibration, of meliorating the said granular arrangement with all the advantages resulting therefrom.

The said process essentially consists in incorporating a wetting and dispersing agent with the mass which it is desired to agglomerate or simply to dry—and which comprises the material to be agglomerated or dried, a liquid, a solution or an emulsion and eventually one or more binding agents. The proportion of wetting and dispersing agent which is to be added to the mass and mixed therewith may be different from one kind of mass to the other but it should be in any case sufficiently large in order that the granular arrangement assumes, under the action of the vibration, an improved structure according to which the mean distance between the centres of gravity or of shape of the grains of solid material to be agglomerated or dried is diminished, which results in increasing the proportion of liquid, for instance of water, which is expelled from the mixture by the vibratory action imparted thereto.

The proportion of wetting and dispersing agent which is used for obtaining this result cannot be fixed, in a general manner, by any law. Preliminary experiences are to be made in every particular case for determining the proportion which gives the result. When starting from a proportion which is equal to traces of wetting and dispersing agent and progressively increasing this proportion, it is to be noted that for each case of use of the same vibratory action the improvement of the granular arrangement generally increases, but that the improvement becomes a constant one from a certain proportion. Therefore, there will be no advantage in exceeding this proportion, since the best result has already been obtained by using it. An adjunction of wetting and dispersing agent corresponding to 0,05–0,25% by weight of the pulverulent material to be agglomerated will generally be convenient for obtaining a good result.

The wetting and dispersing agents which are suitable for carrying the process into practice are those which do not combine with the substances and chemical compounds in presence, in such a manner that combinations are formed which would destroy the said wetting and dispersing agents and substantially diminish their action. Preliminary tests permit of determining whether any known wetting and dispersing agent can be adopted in the case of a given mixture or must be discarded. In a general manner the wetting and dispersing agents used in the textile industry are well suitable for carrying the process into practice. For instance, derivatives will be used, which are obtained by sulphonation of fatty bodies, fatty acids, fatty alcohols, derivatives of the fatty acids such as the esters or amides of these acids. Wetting and dispersing agents can be used which are found on the market and which are based on products obtained through condensation and sulphonation of aromatic hydrocarbons with one or more aldehydes, or also products of the same kind obtained from derivatives of the said hydrocarbons or in the like manner, products obtained by causing a body which is not soluble in water and contains active hydrogen to act on ethylene oxide, by choosing the compounds of this class which are soluble in water, as well as compounds obtained by sulphonation of the residues which are left when distilling benzoic aldehyde.

Another kind of products which are also suitable for carrying out the process are products of vegetable origin which possess a wetting property when dissolved in water, such as for instance, saponin, licorice or lyes left by the treatment of cellulosic materials with sulphites or bisulphites.

The vibrating action which is used for carrying out the process according to the invention can be of the order of the action which is normally used in the manufacture of agglomerated bodies through vibration as, for instance, 5,000 to 6,000 vibrations per minute or even higher.

When applying the hereabove specified process it is possible to lower by 40% and even more the proportion of water contained in a rich mixture adapted for forming a concrete and at the same time to increase the mechanical resistance of the concrete, by using a proportion of wetting and dispersing agent of 2 to 4% (two to four per thousand) with respect to the weight of the water.

The following are non limitative examples of carrying the invention into practice.

Example 1

When starting according to usual technics from a rich mixture showing the following composition:

	Cubic metres
Fine gravel	0,800
River sand	0,400

Portland cement of first quality 400 kgs. one obtains after vibration has occurred, a concrete possessing when set a resistance to compression of 350 kgs. per square centimetre.

If according to the invention, 150 grams of a wetting and dispersing agent such as the sodium salt of a sulphonated concentration compound of naphthalene with formol and a quantity of water lowered to 50 litres are caused to be mixed with the same quantity of solid materials as hereabove recited one obtains after they have been subjected to a vibratory action as hereinbefore specified a concrete having after setting a resistance to compression higher than 700 kgs per square centimetre. Furthermore, the porosity of such a concrete is three times less than the porosity of the foregoing concrete.

Example 2

When agglomerating slamms obtained from the washing of coal and containing 25 to 30% of water, a vibrating action applied to the material to which have been added a wetting and dispersing agent in the proportion of 0,5 to 0,1% of the weight of the water to be expelled leaves a mass which no longer contains more than 5 to 6% of water. By then adding 3 to 5% of cement

with respect to the weight of the so concentrated slamms very resistant briquettes are obtained.

Example 3

To a cubic metre of peat at 80% of water containing 200 kgs of dry material, 400 grams of the wetting and dispersing agent specified in the Example 1 here above are added, being dissolved in water left by a precedent water extraction operation. The mass so added is allowed to soak, then it is vibrated during 70 to 140 seconds according to the colloidal power of the peat, care being taken, according to technics already known per se, that a free metal sheet the shape of which corresponds to the inner contour of the vessel which contains the peat, is placed on the upper surface of the wet peat. Water is expelled from the mass. A peat-cake of 240 to 280 kgs is removed which no longer contains more than 20 to 25% of water. The water left by the extracting operation is conveyed to the mixing machines or to temporary peat stockage vats in view of sparing the wetting and dispersing agent which has been used.

Example 4

By incorporating to flotation coals coming out of the washing room, a wetting and dispersing agent such as that which is quoted in Example 1 hereabove, in the proportion of 0,005% of the weight of the water to be expelled, the water content of the said coals is lowered to 2 to 4% because of the vibrating action.

Similar results are obtained when treating metallic ores in a like manner.

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