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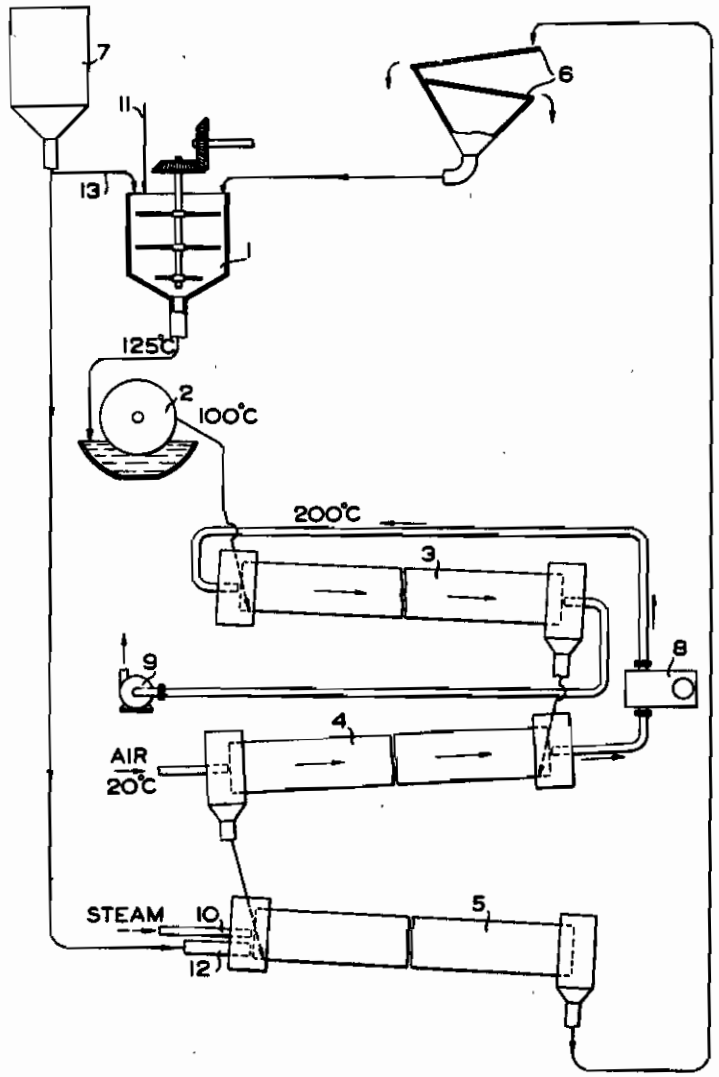

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METHOD FOR MANUFACTURING AN IMPROVED GRANULAR FERTILIZER CONTAINING AMMONIUM NITRATE AND CALCIUM CARBONATE

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The invention relates to a method for manufacturing a fertilizer containing ammonium nitrate and calcium carbonate and consisting of rounded grains having no tendency to cake by virtue of coating the grains with a dry powder.

It has already been suggested to manufacture non-caking grains of fertilizers consisting e. g. of ammonium nitrate and calcium carbonate, by drying well the fertilizer grains and thereafter stirring them with a small amount of a dry powdery material till a smooth cohering coating of that material has been formed on the grains. As suitable substances for coating fertilizer grains consisting of ammonium nitrate and calcium carbonate, chalk and graphite are mentioned. The indication that the fertilizer grains must be well dried, however, is insufficient as a prescription for bringing the grains into such a condition that they can easily be coated with the powdery material. The amount of dry powdery material with which the fertilizer grains are stirred according to this method is about 2 to 5%, but according to my experience it is impossible to obtain a good result with this small quantity.

Moreover it has been proposed to improve the properties of fertilizers such as mixtures of ammonium nitrate and calcium carbonate, by coating of the fertilizer grains with a thin layer of calcium carbonate. According to this method a molten mixture which already contains the main part of the calcium carbonate, is caused to solidify whereupon a small amount of calcium carbonate being sufficient for preventing the caking of the fertilizer grains is added. No attention, however, is paid to the manner of drying and granulating the product and the amount of calcium carbonate used is as small as possible.

Finally it has been suggested to manufacture a uniformly granulated fertilizer by mixing ammonium nitrate and calcium carbonate in moist condition at a slightly elevated temperature. According to this method grains of ammonium nitrate are coated with the total amount of powdery calcium carbonate, which coating must contain a small content of ammonium nitrate as a binding agent. This method does not yield the results obtained according to my invention. It involves the necessity of adding a quantity of ammonium nitrate as a binding agent to the calcium carbonate with which the grains are coated, because the grains to be coated are not pretreated in the manner according to my invention described hereafter.

It is the object of the present invention to provide an improved and effective method for manufacturing a fertilizer containing ammonium nitrate and calcium carbonate and consisting of rounded grains having no tendency to cake to a compact mass.

Another object of the invention is the provision of a method of coating with calcium carbonate the grains of a fertilizer containing ammonium nitrate either mixed with calcium carbonate or not under such conditions that the certainty of successful operation resulting in an improved non-caking fertilizer is assured.

Another object of the invention is to provide a method for manufacturing coated non-caking grains of a fertilizer containing ammonium nitrate and calcium carbonate without danger of explosion.

Other objects and advantages of the invention will be apparent as it is understood by reference to the specification and accompanying drawing which illustrates diagrammatically the practice of the invention. It is understood that the invention is not limited to the details of the flow-sheet and the examples given.

The method according to my invention comprises contacting a flow of moist grains of ammonium nitrate either mixed already with calcium carbonate or not with a parallel flow of air or other gases having a temperature of about 150–250° C., preferably in a drying drum, cooling the grains, coating them with an excess of calcium carbonate powder and thereafter removing the excess of calcium carbonate.

In carrying out my method when coating the grains I prefer to use an excess of calcium carbonate which amounts to two to three times the quantity of calcium carbonate, which adheres to the grains. Thus the grains are mixed with three to four times the amount of calcium carbonate which adheres to the grains.

By various experiments I have found that surprisingly by treatment of the grains with a parallel flow of air or other gases having a high temperature the grains obtain a surface structure adapted to hold by the subsequent mixing with an excess of calcium carbonate such an amount of calcium carbonate on the surface that the grains do not cake when transported and stored. By this treatment by heat and the action of the apparatus, for which I preferably use a drying drum, the fertilizer grains obtain a rounded form, which is very important in view of their use as a fertilizer. By many experiments I have determined that without a pretreatment of the grains with a parallel flow of gases having a temperature of 150–250° C. is not possible to give such a na-

ture to the grain surface that by coating the tendency of the grains to cake is sufficiently repressed.

It is known that it is dangerous to heat ammonium nitrate at a high temperature. I have found, however, that the grains of ammonium nitrate either mixed with calcium carbonate or not may be treated by air or other gases having a temperature of about 150–250° C. without any danger for explosion if care is taken that the water content of the fertilizer amounts to 1–5%. Therefore, I prefer to introduce the fertilizer to be dried into the drying apparatus with a water content from 1–5%. In this case the product leaving the drying apparatus has a water content from 0.3 to 1.0%.

The grains of ammonium nitrate either mixed with calcium carbonate or not, which must be treated according to my invention, may be obtained in different ways. It is e. g. possible to start from molten ammonium nitrate containing water, which is solidified by cooling and kneading, by spraying or by means of a cooling roller.

Although a good result is also obtained by coating the grains with calcium carbonate at an elevated temperature of e. g. 50–70% C., I have discovered that the best results are obtained by operating at about 25° C. For at this temperature the operation proceeds below the conversion temperature (32° C.) of modification III of the ammonium nitrate in modification IV (the conversion of the rhombic or monoclinic form into rhombic bipyramidal form, vide Gmelin, Handbuch der anorganischen Chemie, 8th Edition, System number 23, fascicle 1 (1936), page 95) and modification IV seems to be the most favourable for the process according to my invention.

Moreover I have found that during the coating operation it is necessary to maintain a sufficient moisture content in the atmosphere of the coating apparatus. It is desirable to regulate this moisture content of the atmosphere in such a way that the grains can absorb moisture from this atmosphere. This regulation of the moisture content may be effected by introducing steam. In many cases, however, it is superfluous to take special measures since the moisture content of the atmospheric air flowing through the coating apparatus is already sufficient.

The accompanying drawing shows a flow-sheet serving to illustrate the way in which my process may be carried out.

Molten ammonium nitrate of e. g. 92% having a temperature of 130–135° C, which in the vessel 1 has been mixed with finely ground marl (calcium carbonate) is solidified and granulated on a cooling roller 2 where the liquid mass is solidified by means of cold water. The product cut from the cooling roller has a temperature of 100° C and a water content of about 3%.

This granulated product containing ammonium nitrate and calcium carbonate is then conducted through the drying drum 3 in parallel flow with hot gases. This drying drum has a length of about 12 m. On the first 3 m the rounding of the grains takes place and in contradistinction to the further part of the drum this part is constructed without arrangement of baffles. After the material has been converted into rounded grains and thereby has already been somewhat dried, a further drying takes place. The temperature of the hot gases is about 200° C; the gases are obtained in the furnace 8 and are drawn off by the exhauster 9. Thereafter the product has still a water content of about 1%. It is conducted to a cooling apparatus, the drum 4 in the drawing, in which it is cooled to about 40–50° C by means of atmospheric air in counter-current. After this the product goes to the coating apparatus, which according to the drawing is also a drum 5, in which it is mixed with a continuous flow 12 of dried and ground marl from the vessel 7. A substantial part of this ground marl adheres to the surface of the fertilizer grains and the weight of the grains thereby increases with about 7%. The calcium carbonate is added in an excess being equal to two or three times the amount which adheres to the grains by the powdering operation. In order to maintain the exact moisture content in the coating apparatus 10–30 kg/h of saturated steam is introduced at 10 for a daily production of about 600,000 kg fertilizer. The fertilizer leaving the coating apparatus is conducted together with the excess of calcium carbonate to the sieve 6, where the excess of calcium carbonate is removed from the product and is returned to the vessel 8.

It is remarked that while the constituents of the fertilizer are mainly added at the spots 11 (ammonium nitrate) and 12 (calcium carbonate), also marl from the bunker 7 may be introduced in the vessel 1 by the line 13, whereby the exact composition of the fertilizer can be regulated to any desired extent.

In the manufacture of a daily quantity of 500,000 kg of e. g. a fertilizer consisting of 60% ammonium nitrate and 40% calcium carbonate 330,000 kg ammonium nitrate in the form of a molten product of 92% is added at 11, while 85,000 kg ground marl are added at 13 and 135,000 kg ground marl at 12. From the 135,000 kg of marl added at 12 a quantity of 38,000 kg adheres to the surface of the grains so that there is an excess of 97,000 kg of marl in the coating apparatus. This excess is separated from the grains on the sieve and is returned to the vessel 1.

The fertilizer containing ammonium nitrate and calcium carbonate which is manufactured according to my invention has rounded grains and does not cake when transported and stored. The method according to my invention may be easily carried out continuously in large scale operation.

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

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