

PATENT SPECIFICATION

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 (72) Inventors VINCENZO LAGANA and UMBERTO ZARDI



(54) PROCESS FOR RECOVERING UREA POWDER

(71) We, SNAMPROGETTI S.P.A., an Italian Company, of Corso Venezia 16, Milan, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a process for recovering urea powders from suspensions of the powders in gases or gaseous mixtures. More particularly, but not exclusively, the present invention relates to a process for recovering urea powders from an apparatus in which such powders are prilled or granulated.

From the apparatuses used for prilling and granulating urea significant amounts of powders are discharged into the air, the powder being transported by the air used in both operations for cooling the obtained granules or prills.

By "prilling" is meant that operation in which a molten mass of a material is sprayed into an upper zone of a tall chamber, and a stream of air, in countercurrent to the falling drops of liquid, is introduced into the chamber to cool the drops and solidify the same. The product obtained by prilling is said to be in the form of prills.

Thus, in the particular case of the preparation of prilled urea, molten urea is passed to a suitable spraying system and the resulting drops (of spray) meet an uprising stream of air. In this way urea prills collect at the bottom of the tower, and the prills can be discharged by suitable means.

The powder, which forms, leaves the prilling tower from an upper region of the tower, and can either be directly discharged into the air or be recovered.

The direct discharge of the urea powder into air clearly results in the loss of urea, and moreover causes pollution of the air and surrounding land.

According to the present invention, there is provided a process for recovering urea powder from a suspension of the powder in a gas or gaseous mixture, which process

comprises feeding the suspension of the urea powder in a gas or gaseous mixture to an ejector (as hereinafter defined) having as the driving fluid a liquid, whereby the liquid driving fluid dissolves or suspends the urea powder originally suspended in the gas or gaseous medium; and recovering urea powder from the solution or suspension of the same in the liquid driving fluid.

The term "ejector" as used herein is defined as a device which allows a mixture of a gas and a powder to be entrained by a driving liquid in a manner which permits good mixing between the gas, powder and liquid.

Preferably the gaseous mixture is air.

Preferably the liquid driving fluid is water.

One embodiment of the process of the present invention provides a process for recovering urea powder from a prilling plant wherein the urea powder is removed from the prilling zone in a mixture with air, which process comprises adding water to the mixture of air and urea powder, then feeding the resulting mixture to an ejector in which the mixture constituted by air, water and urea powder contacts an aqueous urea solution which is circulated in a cycle between the ejector and a collecting tank provided downstream of the ejector, passing the urea solution obtained in the ejector and the air to the collecting tank, withdrawing separated air from the collection tank, withdrawing urea solution from the separating tank, circulating part of the withdrawn solution in the cycle, removing the remainder of the withdrawn urea solution from the cycle, and recovering urea powder from the removed remainder of the withdrawn solution.

It is possible to recover the powder leaving prilling or granulation plants in a substantially complete manner and at low cost by utilizing the ejector working with a liquid as driving fluid.

The powder dissolves in or becomes suspended in the liquid to provide a sufficiently concentrated solution or

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suspension which can be subsequently utilized as such or further concentrated in order to recover the powder.

For a better understanding of the present invention and to show how the same may be carried out, reference will now be made, by way of example, to the accompanying drawing which shows an apparatus suitable for carrying out the process of the present invention.

The illustrated apparatus includes a pipe 1 for feeding molten urea to an upper region of a prilling tower 2, and a pipe 3 for feeding air to a lower region of the tower 2. Urea prills are discharged through a pipe 4. Urea powder and air are collected in a collection chamber 5 and conveyed through pipes 6 to an ejector 7.

Communicating with the pipe 6 is a pipe 8 for adding make-up water to the stream of urea powder and air before the stream enters the ejector 7.

To the ejector 7 there is fed through a pipe 12 a stream of driving fluid, which stream is constituted by water containing dissolved urea. Downstream of the ejector 7 is a tank 9 from which urea solution is withdrawn through a pipe 10 and pressurized by means of pump 11. Part of the pressurized solution of urea is fed to the ejector 7 via the pipe 12, whereas another part of that solution is discharged through a pipe 13 and sent to appropriate plant (such as an evaporator) for recovering the urea contained in the solution.

Air which has been passed through the ejector 7 is discharged from the tank 9 through a pipe 14.

Although variations on this embodiment of the process according to the present invention are possible, the advantages of the illustrated embodiment are that the ejector is used for creating the vacuum sufficient to draw off the stream of air and powder, and that the powder is taken up by the driving liquid used in the ejector.

Although air has been mentioned as the gas for entraining the powder, it will be appreciated that any other gas could be used in the column 2 for carrying away the powder; similarly a liquid other than water can be used for absorbing the powder which need not necessarily dissolve in the liquid but can simply remain suspended in the liquid.

The following example illustrates the present invention.

EXAMPLE

The process was carried out in an apparatus as illustrated in the accompanying drawing. There were fed to a prilling tower 2 726,000 Ncm³/hour of air through pipe 3 and 62,500 kg/hour of molten urea through pipe 1. The abbreviation "Ncm³" represents a

cubic centimetre of gas as measured under standard conditions of temperature and pressure.

From the top of the prilling tower, powdered urea passed out in pipe 6 at a rate of 625 kg/hour together with all of the air which had been fed.

The air-powdered urea mixture was fed to the ejector 7, after the addition of water introduced through pipe 8 at a rate of 2505 kg/hour. All the air which passed through the ejector was discharged through pipe 14. Water containing dissolved urea was circulated by means of the pump 11 through a closed cycle constituted by pipes 10 and 12, ejector 7 and tank 9. The rate of circulation of the water was 3900 m³/hour. Through pipe 13 was discharged a stream constituted by 2505 kg/hours of water and 625 kg/hour of urea.

WHAT WE CLAIM IS:—

1. A process for recovering urea powder from a suspension of the powder in a gas or gaseous mixture, which process comprises feeding the suspension of the urea powder in a gas or gaseous mixture to an ejector (as hereinbefore defined) having as the driving fluid a liquid, whereby the liquid driving fluid dissolves or suspends the urea powder originally suspended in the gas or gaseous medium: and recovering urea powder from the solution or suspension of the same in the liquid driving fluid.

2. A process as claimed in claim 1, wherein the urea powder is formed in a plant for prilling urea.

3. A process as claimed in claim 1, wherein the urea powder is formed in a plant for granulating urea.

4. A process as claimed in any preceding claim, wherein the liquid used in the ejector is water.

5. A process according to any preceding claim, wherein the gaseous mixture in which the urea powder is originally suspended is air.

6. A process substantially as hereinbefore described with reference to the accompanying drawing.

7. A process substantially as described in the foregoing Example.

8. A process for recovering urea powder from a prilling plant wherein the urea powder is removed from the prilling zone in a mixture with air, which process comprises adding water to the mixture of air and urea powder, then feeding the resulting mixture to an ejector (as hereinbefore defined) in which the mixture constituted by air, water and urea powder contacts an aqueous urea solution which is circulated in a cycle between the the ejector and a collecting tank provided downstream of the ejector,

suspension which can be subsequently utilized as such or further concentrated in order to recover the powder.

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Although variations on this embodiment of the process according to the present invention are possible, the advantages of the illustrated embodiment are that the ejector is used for creating the vacuum sufficient to draw off the stream of air and powder, and that the powder is taken up by the driving liquid used in the ejector.

Although air has been mentioned as the gas for entraining the powder, it will be appreciated that any other gas could be used in the column 2 for carrying away the powder; similarly a liquid other than water can be used for absorbing the powder which need not necessarily dissolve in the liquid but can simply remain suspended in the liquid.

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2. A process as claimed in claim 1, wherein the urea powder is formed in a plant for prilling urea.

3. A process as claimed in claim 1, wherein the urea powder is formed in a plant for granulating urea.

4. A process as claimed in any preceding claim, wherein the liquid used in the ejector is water.

5. A process according to any preceding claim, wherein the gaseous mixture in which the urea powder is originally suspended is air.

6. A process substantially as hereinbefore described with reference to the accompanying drawing.

7. A process substantially as described in the foregoing Example.

8. A process for recovering urea powder from a prilling plant wherein the urea powder is removed from the prilling zone in a mixture with air, which process comprises adding water to the mixture of air and urea powder, then feeding the resulting mixture to an ejector (as hereinbefore defined) in which the mixture constituted by air, water and urea powder contacts an aqueous urea solution which is circulated in a cycle between the the ejector and a collecting tank provided downstream of the ejector,



- passing the urea solution obtained in the ejector and the air to the collecting tank, withdrawing separated air from the collection tank, withdrawing urea solution
- 5 from the separating tank, circulating part of the withdrawn solution in the cycle, removing the remainder of the withdrawn urea solution from the cycle, and recovering urea powder from the removed remainder
- 10 of the withdrawn solution.
9. A urea powder whenever recovered by a process according to any preceding claim.

HASELTINE LAKE & CO.,
Chartered Patent Agents,
28 Southampton Buildings,
Chancery Lane,
London WC2A 1AT,
—and—
Temple Gate House,
Temple Gate,
Bristol BS1 6PT,
—also—
9 Park Square,
Leeds LS1 2LH.

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