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PRILLING TOWER

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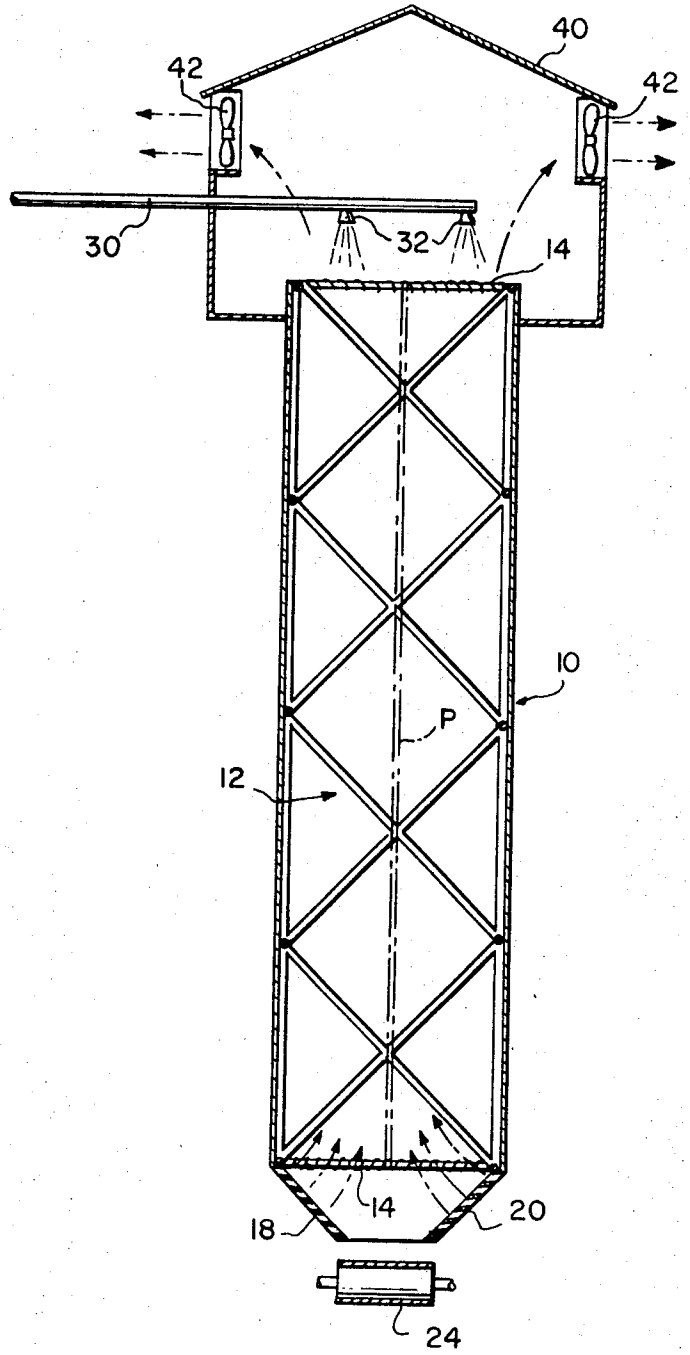

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PRILLING TOWER

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ABSTRACT OF THE DISCLOSURE

A prilling tower includes a shaft the walls of which are made of a flexible nonwettable corrosion resistant material having low thermal conductivity. The walls are preferably formed of plastic material or plastic coated fabric. The walls may be employed for covering the shaft walls of a conventional prilling tower, or the walls may be attached to a rigid framework. In one form of the invention, the tower comprises at least two shafts having one shaft wall in common.

BACKGROUND OF THE INVENTION

The prilling process is a known manner of producing granular products from liquid melts and concentrated solutions. The liquid is fed through suitable nozzles and divided into droplets which fall through a gaseous medium, usually air, which cools the droplets so that they solidify into spherical granules or pellets. When the liquid fed through the nozzles is a solution, solidification is accompanied by partial or complete evaporation of the solvent used.

The prilling technique is industrially employed among other things in the manufacture of urea prills and ammonium nitrate prills as well as other substances which form melts or concentrated solutions, particularly those having water as a solvent.

A prilling plant generally includes a high tower which encloses a prilling shaft. The nozzles are usually mounted at the top of the shaft and the droplets fall downwardly in the shaft and contact a steram of upwardly moving cooling air introduced at or near the bottom of the shaft. In order to give the droplets sufficient time to solidify into prills during their fall, shafts of considerable height are required. For example, fertilizer grade ammonium nitrate prills are manufactured in towers which often are more than 100 meters in height. Early prilling towers were of brick construction, and later types of towers have usually been built as monolithic constructions of reinforced concrete. Towers of the height and construction mentioned above are very heavy and bulky and require a high initial investment.

Especially when the nozzles are not operating properly, the walls of the prilling shaft become covered with solid deposits of the prilled material. Such deposits disturb the flow pattern within the shaft, and accordingly, as the deposits build up on the walls of the shaft, it becomes necessary to interrupt operation of the apparatus to clean and wash the shaft with water. The salt solutions thus formed have a corrosive action on the walls of the shaft.

In order to reduce the build-up of deposits on the shaft walls and to eliminate corrosion, it is common practice to cover the shaft walls with metals such as stainless steel or aluminum. This type of construction is often used where concrete walls are provided, and these materials have also been employed to cover the shaft walls wherein the shaft is of a construction other than concrete.

SUMMARY OF THE INVENTION

In the present invention, the above-discussed disadvantages of conventional prilling towers are eliminated by providing a prilling tower wherein the walls of the shaft are made of flexible, nonwettable corrosion resistant material having low thermal conductivity. Suitable materials are sheets of plastic or plastic coated fabric. Plastics which are particularly suited for use in the present invention are polyethylene, chlorosulfonated polyethylene and polyvinyl chloride. A suitable fabric for use in the invention is nylon.

The shaft walls of flexible material as discussed hereinabove according to the present invention may be employed for covering the shaft walls of a conventional prilling tower formed of the usual materials. Additionally, the material of the present invention may be employed to form intermediate partition walls dividing conventional prilling towers into a plurality of shafts.

A preferred embodiment of the invention comprises a prilling tower including a rigid framework formed of metal or the like, and wherein the plastic wall material is attached to the framework to form the shaft.

Use of the material according to the present invention in the shaft walls of prilling towers provides a number of substantial advantages over prior art constructions. The flexible wall material according to the invention is of lightweight construction and accordingly it can be added to existing prilling towers without substantially increasing the total weight of the tower. Additionally, the material enables new lightweight low cost prilling towers to be readily constructed.

The flexible material is easy to mount in operative position and may without the use of any special tools or equipment be easily shaped to provide shafts having a desired horizontal cross-section. Furthermore, the horizontal cross-section may be readily altered as by making the shaft walls movable or by providing the tower with intermediate partition walls of similar flexible material.

The wall material of the present invention require no maintenance and it is not corroded by the melt or the solution to be prilled or by dilute aqueous solutions containing the same or other chemicals.

A prilling tower comprising a rigid framework having flexible shaft walls attached thereto and providing a shaft of generally rectangular cross-sectional configuration has the additional advantage that the production capacity of the plant can be increased in a simple and economical manner by adding one or more adjoining towers of similar construction in such a manner that adjacent towers define shafts having at least one shaft wall in common.

A prilling tower according to the present invention offers significant operating advantages since the low thermal conductivity of the flexible material of the shaft wall and its lower surface tension towards the melt or solution to be prilled causes the deposits on the shaft walls to adhere poorly to the wall so that the deposits can be easily removed.

Additionally, the shaft walls are attached to the framework in such a manner that they may be flexed. This enables the deposits on the shaft walls to be removed therefrom by shaking or vibrating the walls. Accordingly, interruptions for cleaning with water and the accompanying formation of crystal pulps or solutions in the bottom of the tower are eliminated.

The operational advantages of providing poor adherence of deposits and enabling the deposits to be removed by shaking or vibrating the shaft walls are particularly important when the droplets are formed by means of high pressure nozzles or by means of centrifugal sprayers such as discs or perforated cylinders which rotate with relative-

ly high speed. Such devices are often used in the manufacture of products such as fertilizers or the like.

The prilling process can be carried out with an optimal flow pattern within the shaft since the horizontal cross-section of the shaft can be made smaller than usual without risk of disturbances and interruptions of operation.

Since the cross-section of the shaft can be readily changed as discussed hereinabove, the flow pattern in the shaft can be varied thereby enabling a single prilling tower to be utilized for the manufacture of prills having different properties such as size, porosity and chemical composition, etc.

When high and uniform quality is required as to prill size and prill size distribution, shape, moisture content, porosity and mechanical strength, it is necessary to permanently maintain within narrow limits all of the optimum operating conditions. In such a case, the spraying device may suitably comprise a multi-hole-orifice nozzle which is constructed in such a known manner as to enable interference free operation with droplet formation occurring at a point spaced from the orifices.

This is achieved by regulating the pressure on the melts or solution being forced through the nozzles so that the melt or solution leaves the orifices as an unbroken stream having a substantially laminar flow. The streams under the influence of surface tension at a suitable level in the shaft are disrupted into droplets. The cooling air is regulated to solidify the droplets to prills and to control porosity at such lower level of the shaft where the droplets have attained a spherical shape. A prilling tower having a small horizontal cross-section and which enables the flow pattern of the shaft to be varied makes it possible to regulate, control and maintain ideal conditions for such a sequence of process steps.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is a vertical section through a prilling tower according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, the prilling tower includes an elongated rigid hollow framework **10** formed of suitable metallic members interconnected with one another to provide an open framework of substantially rectangular cross-sectional configuration. The walls **12** of the tower are formed of a flexible nonwettable corrosion resistant material having low thermal conductivity as discussed hereinbefore and preferably comprise a sheet of nylon fabric coated with polyvinyl chloride. The flexible walls are attached to the framework by any suitable means. They may for example be attached to the upper and lower edges of the framework and by means of a number of firmly braced corrosion resistant wires **14** positioned inside the flexible walls be pressed against the corners and sides of the framework. The fabric may be further fastened to the framework at spaced points along the side thereof in such a manner that the fabric maintains its flexibility.

A pair of sloping side walls **18** and **20** are provided at the bottom of the tower and are of a louver construction to enable air to pass freely therethrough. A conveyor belt **24** is disposed beneath the sloping walls **18** and **20** for receiving prills from the tower.

A conduit **30** connected with a suitable source of liquid melt or solution is provided with a plurality of nozzles **32** for producing the desired droplets. These nozzles are disposed within an enclosure **40**. A plurality of fans **42** are mounted in the enclosure for drawing air upwardly through the shaft defined by the framework and flexible walls and thence outwardly of the enclosure **40**.

The tower may also include a partition indicated by phantom line P formed of the same material as the walls of the tower for dividing the tower into a plurality of adjacent shafts.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present invention is therefore illustrative and not restrictive, and since the scope of the invention is defined by the appended claims, all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents are therefore intended to be embraced by those claims.

What is claimed is:

1. A prilling tower which comprises:
(a) a rigid vertical framework;
(b) walls attached to said framework, said walls comprising flexible non-wettable corrosion resistant material having low thermal conductivity;
(c) said walls forming a vertical shaft of generally rectangular cross-sectional configuration in said prilling tower;
(d) a spraying means located at the upper portion of the prilling tower to divide a liquid flowing therethrough into droplets;
(e) said spraying means being positioned so that said droplets will fall downwardly in said shaft;
(f) a gas inlet located at or near the bottom of said tower and positioned so that said gas will flow into said shaft and contact said falling droplets; and
(g) a product outlet located at the lower level of said shaft.

2. A prilling tower as defined in claim **1** wherein said walls are made of sheets of plastic material.

3. A prilling tower as defined in claim **1** wherein said walls comprise plastic coated fabric.

4. A prilling tower as defined in claim **1** wherein said walls comprise nylon fabric coated with polyvinyl chloride.

5. A prilling tower as defined in claim **1** wherein said walls are made of plastic selected from the group consisting of polyethylene, chlorosulfonated polyethylene and polyvinyl chloride.

6. A prilling tower as defined in claim **1** wherein the prilling tower includes at least two shafts having one shaft wall in common.

7. The tower of claim **1** wherein said walls are movable.

8. The tower of claim **1** wherein the bottom of the tower comprises a pair of sloping side walls which are of a louver construction to provide said gas inlet.

9. The tower of claim **1** wherein said spraying means are disposed within an enclosure.

10. The tower of claim **1** wherein a plurality of fans are mounted in said enclosure in order to draw air upwardly through said shaft and outwardly through outlets of said enclosure.

11. The tower of claim **1** wherein said walls are attached to said framework in such a manner that they may be flexed.

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