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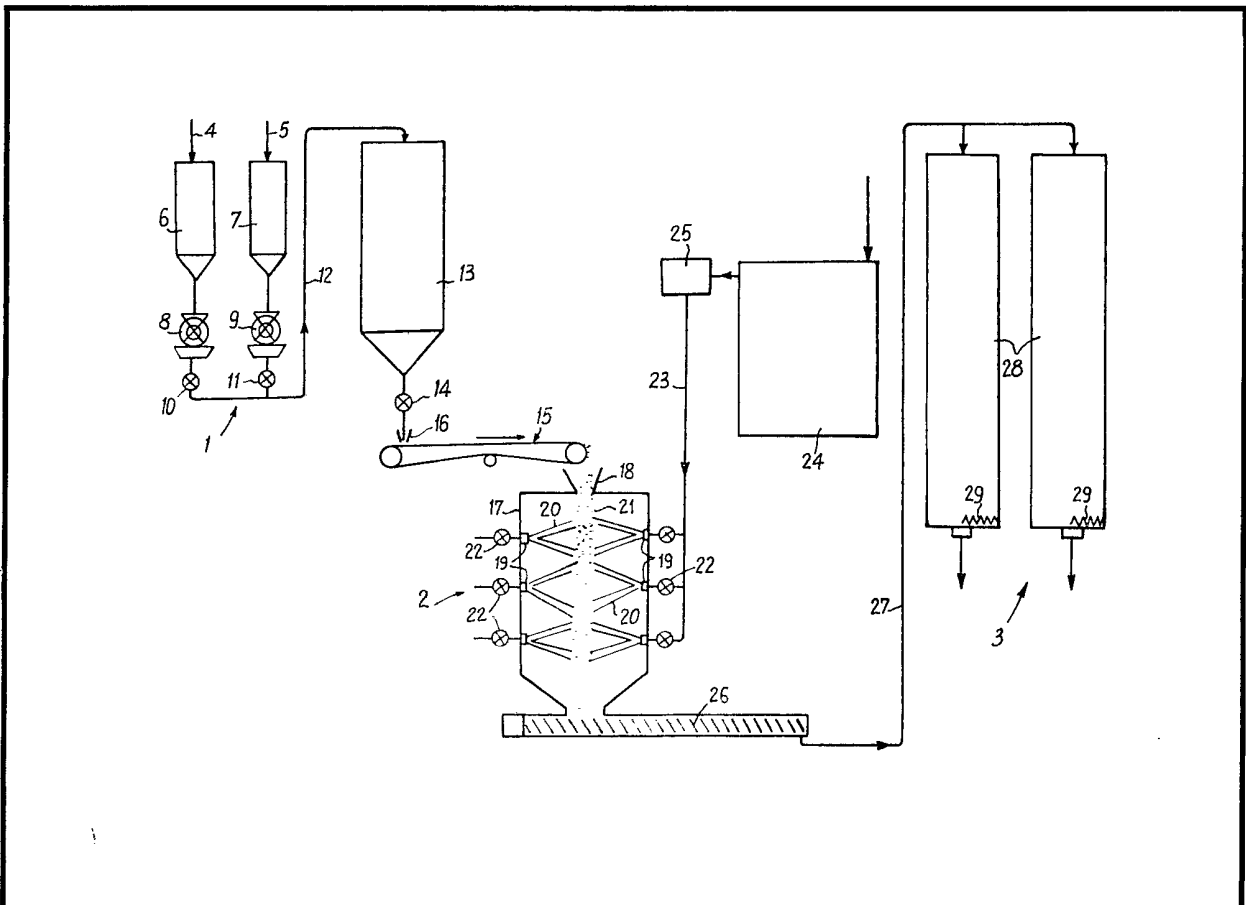
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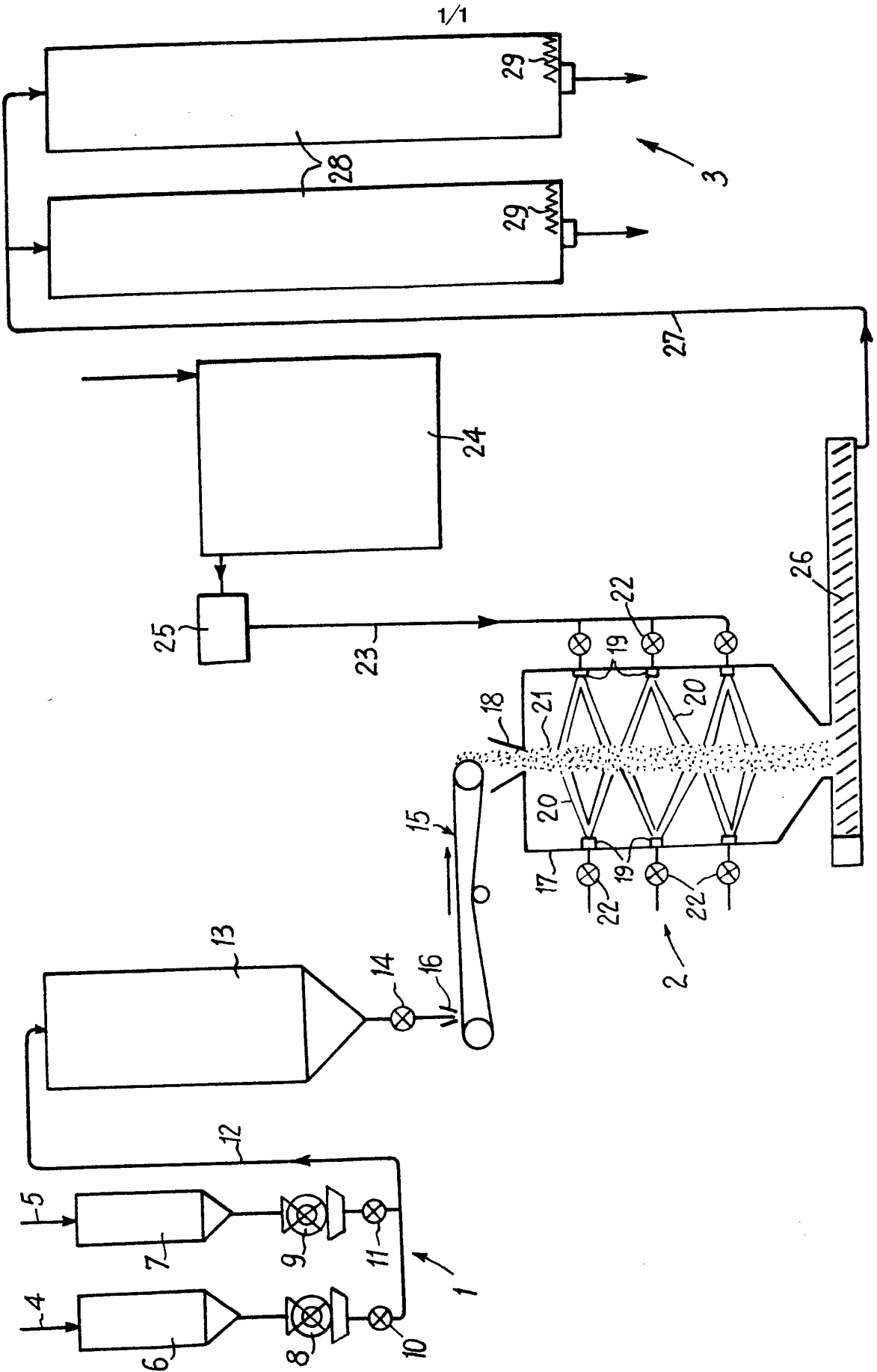
lets, the wetted material being collected at the bottom of the chamber. The method has application to the tanning of protein materials for feeding cattle.

(54) A method and device for processing a pulverulent material, using a liquid

(57) Pulverulent material is conveyed to the top inlet 18 of a processing chamber 17, and through the chamber by gravity, liquid being sprayed at 20 into the processing chamber at an angle to the vertically falling material so that the particles of material are uniformly wetted by the sprayed drop-



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SPECIFICATION

A method and device for processing a pulverulent material, using a liquid

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The invention relates to the processing of a pulverulent material by at least one liquid.

It applies more particularly though not exclusively to the tanning of protein materials for feeding ruminants; in this application, the object of treatment is to enable substances to be assimilated in the digestive tube without being degraded by deamination, which normally occurs in the rumen.

15 An object of the invention inter alia is to provide a method and device for the aforementioned treatment to be carried out continuously and in a controlled manner.

According to the present invention there is provided a method of processing a pulverulent substance using a liquid, comprising preparing the material to be processed in pulverulent form having a suitable particle size, conveying the pulverulent material to the top inlet of a processing chamber, conveying the material through the chamber by gravity, spraying the liquid into the processing chamber at an angle to the vertically falling material so that the particles of material are uniformly wetted by the sprayed droplets, and collecting the wetted material at the bottom of the chamber.

A device for working the method according to the invention is characterised in that it comprises a conveyor for the pulverulent material, a processing chamber having a top inlet near the conveyor outlet and a bottom inlet, and at least one spray nozzle adapted to spray the processing liquid into the chamber at an angle to the vertical stream of pulverulent material.

The invention will be described now by way of example with particular reference to the accompanying drawing, which is a general diagram of an installation for tanning protein substances.

The following description relates to the non-limitative application of the invention to tanning a pulverulent mixture by means of a liquid.

50 The installation comprises a crushing and mixing station 1, a processing station 2 and a station 3 for storage after treatment.

Raw material is supplied to station 1 through a line 4, 5 and delivered to a vessel 55 6, 7 associated with a crushing device 8, 9, e.g. of the hammer kind, followed by a valve 10, 11.

The raw material, after reaching an appropriate grain size is delivered to an outlet line 60 12. It is then conveyed to a storage cell or silo 13 having an outlet controlled by a valve 14 and vertically in line with the inlet of a horizontal belt conveyor 15. The pulverulent material is delivered to the belt 15 through a 65 sectional chute 16 or the like, adapted to

distribute the material all the way across the belt. The belt 15 is of the weighing kind.

Usually, one vessel 6, 7 is associated with one line 12 and one silo 13 so that only a single substance is processed at one time. Accordingly, the number of lines 12 and silos 13 will be equal to the number of vessels 6 and 7. In some special applications the raw materials can be mixed, in which case a 70 proportioning device and a mixing device will be provided to give the desired composition and uniformity to the mixture.

After leaving belt 15, the material falls by gravity into a spray chamber 17 through a sectional hopper 18 adapted to give a suitable cross-section (circular, rectilinear, rectangular, etc) to the vertical stream 21 of falling material.

A suitable number of suitably-positioned 85 spray nozzles are disposed around the sides of chamber 17 and each emits a jet 20 of fine droplets of processing liquid at an angle to the stream 21. Nozzles 19 are disposed e.g. on both sides of stream 21 and are designed so that jets 20 are conical, inter alia hollow cones, having a horizontal axis and meeting at the stream 21. Nozzles 19 are e.g. each actuated by an adjusting valve 22. All the valves 22 are supplied with processing liquid 90 through a common line 23 coming from a storage tank 24 and supplied via a control and inter alia proportioning device 25.

In the special application under consideration, tank 24 is a buffer tank containing a solution of formic aldehyde diluted to 30%. The buffer tank is adapted to maintain a constant temperature, thus eliminating the risk of polymerisation and enabling the polymers formed to be decanted, thus preventing 105 nozzles 19 from clogging up and enabling the volume to be checked as a precaution.

After leaving the spray chamber, the wet material is conveyed by a screw 26 which also intimately mixes the particles and thus 110 improves the uniformity with which the processing liquid is distributed.

If necessary, the material is made additionally uniform in order to distribute the excess liquid (the welding effect). It is then conveyed 115 through a line 27 to at least one storage and maturing silo 28. The purpose of maturing is to form insoluble complexes and reduce the proportion of free formaldehyde. At the bottom, the silo comprises an extraction device 120 29 consisting of an axially horizontal conveying screw rotating around its axis so as to convey the material towards the centre of the silo, where there is an extraction aperture. The screw is driven in a scraping, circular, axially 125 vertical movement coaxial with the silo, resulting in regular extraction throughout the silo cross-section, thus avoiding the well effect and enabling a single silo to be used for maturing and for distribution. A number of 130 sets of silos 28 are provided, equal to the

number of raw materials to be treated.

In a variant, the constituents can be reheated after treatment to reduce the time required for maturing, which is at least 5–8 days in the example.

The installation comprises a monitoring and control system for supervising the various operating parameters and stopping operation if the limited tolerances are exceeded by the liquid and/or the substance for processing and/or the processed substance.

As the preceding description shows, the present installation is reliable, can easily be incorporated in a cattle-food factory, and can be controlled and monitored at a distance and can thus be operated at a reasonable cost.

By means of the installation, the particles to be processed can be brought into very uniform contact with the liquid, thus avoiding faulty distribution of the liquid which would result either in an excess of liquid (excess tanning which reduces digestibility in the digestive tube) or in insufficient liquid (insufficient tanning, so that the protein material is easily degradable in the rumen).

CLAIMS

1. A method of processing a pulverulent substance using a liquid, comprising preparing the material to be processed in pulverulent form having a suitable particle size, conveying the pulverulent material to the top inlet of a processing chamber, conveying the material through the chamber by gravity, spraying the liquid into the processing chamber at an angle to the vertically falling material so that the particles of material are uniformly wetted by the sprayed droplets, and collecting the wetted material at the bottom of the chamber.

2. A method according to claim 1 characterised in that the pulverulent material and the liquid are proportioned before treatment.

3. A method according to claim 1 or claim 2 characterised in that the stream of material entering the spray chamber is shaped.

4. A method according to any of claims 1 to 3 characterised in that the material is mixed after treatment.

5. A method according to any of claims 1 to 4 characterised in that the treatment material is matured.

6. A method according to any of claims 1 to 5 characterised in that the treated material is heated.

7. A device for carrying out the method according to any of claims 1 to 6, characterised in that it comprises a conveyor for the pulverulent material, a processing chamber having a top inlet near the conveyor outlet and a bottom inlet, and at least one spray nozzle adapted to spray the processing liquid into the chamber at an angle to the vertical stream of pulverulent material.

8. A device according to claim 7 characterised in that it comprises means for propor-

tioning the pulverulent material and liquid upstream of the spray chamber.

9. A device according to claim 7 or claim 8 characterised in that a hopper for shaping the stream of material in the chamber is provided at the chamber inlet.

10. A device according to any of claims 7 to 9 characterised in that it comprises a conveying and mixing device downstream of the spray chamber.

11. A device according to any of claims 7 to 10 characterised in that it comprises a number of nozzles adapted to emit conical jets which intersect at the stream of material.

12. A device according to any of claims 7 to 11 characterised in that it comprises a buffer tank for decanting the liquid.

13. A device according to any of claims 7 to 12 characterised in that it comprises at least one silo in which the material is matured and, on extraction, is distributed by a screw at the bottom rotating around a vertical axis.

14. Application of the method according to any of claims 1 to 6 and the device according to any of claims 7 to 13 to the tanning of protein substances, e.g. by formic aldehyde, to obtain food for cattle.

15. A method of processing a pulverulent substance substantially as hereinbefore described.

16. A device as claimed in claim 7 and substantially as hereinbefore described with reference to and as shown in the accompanying drawing.