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3,266,781

MIXING MACHINE

Filed June 23, 1964

2 Sheets-Sheet 1

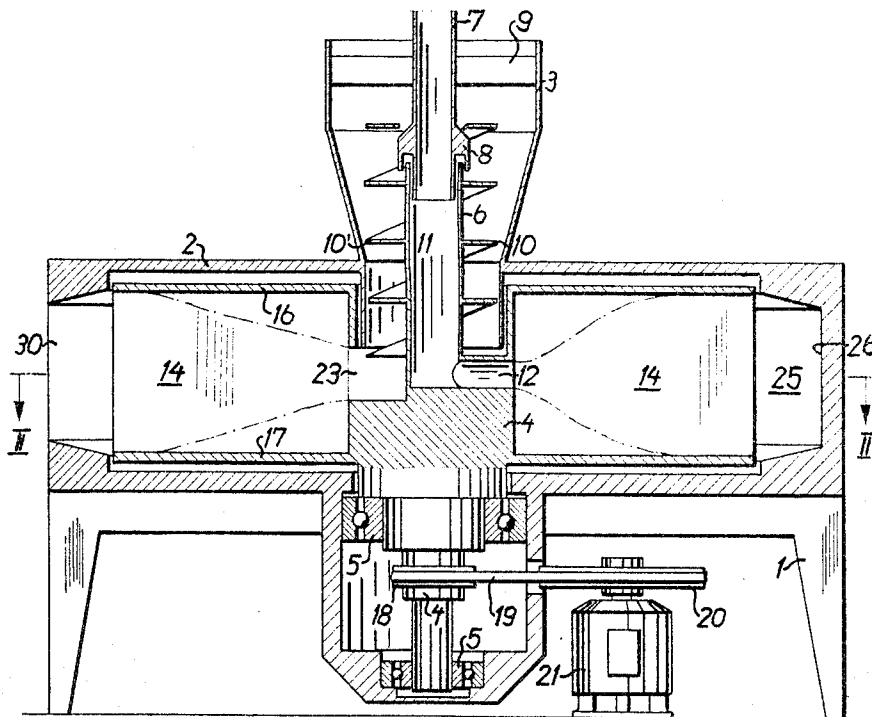


Fig. 1

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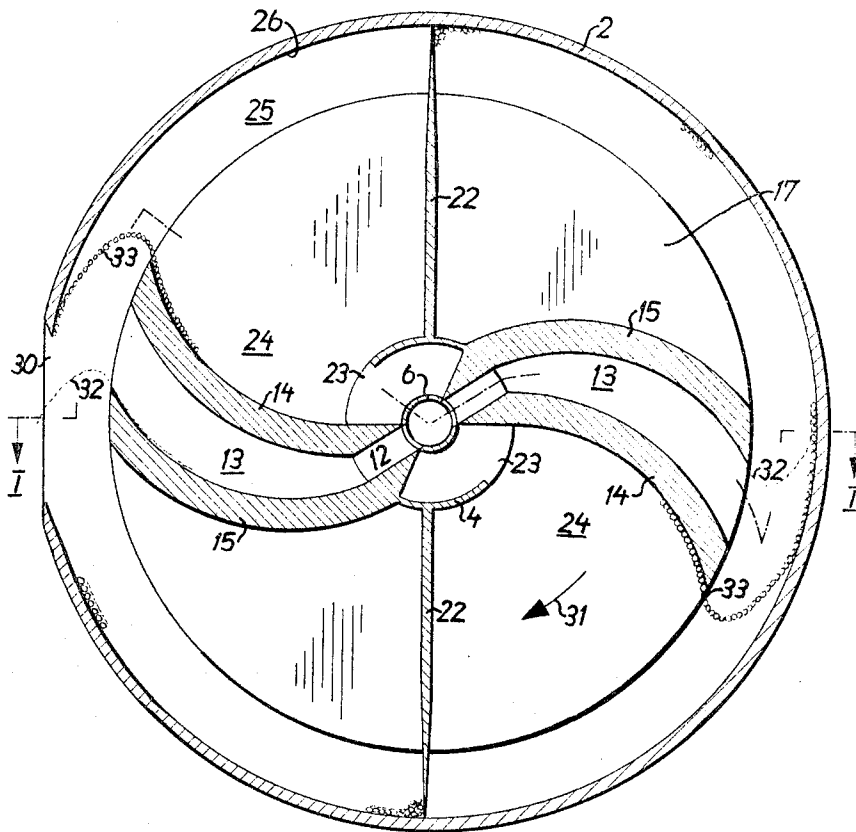


Fig. 2

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MIXING MACHINE

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9 Claims. (Cl. 259—43)

Mixing and blending liquid or granular substances by means of mixing machines having one or more impeller rotors are already well known. In these devices the impeller axis is usually vertically disposed and the various constituent components to be mixed are usually dropped or flung from different heights onto the entire circumference of the rotors, the individual jets intersecting in the air. Material thrown onto the wall of the mixing chamber is peeled off. The quality of the final product remains left to various hazards. Since the individual particles are of different size and the point of intersection of their paths are undetermined or even most uncertain, occasional lump-formation can take place.

A main object of this invention is to provide means to overcome the above mentioned drawbacks. This invention therefore relates to a mixing machine having an impeller rotatably disposed in a mixing chamber and arranged to spray a plurality of constituent substance components to be mixed onto a substantially cylindrical surface. The mixing machine according to this invention is characterized in that as the impeller rotor is provided with a plurality of individual substantially radial accelerating or impelling tracks having their axes in the same normal plane of and arranged in consecutive order of succession around the axis of rotation.

Owing to this arrangement the quality of the mixture obtained does no longer depend upon an uncertain intersection of indefinite paths of the particles, but a plurality of thin films of the individual constituent substance components are formed on account of their uniform dispersion on the annular or cylindrical surface ensuring a high degree of blending already at this stage of the process.

A further development of this invention includes scraping means for the cylindrical surface which rotate at synchronous speed with the rotor and simultaneously remove the films immediately after their formation preventing thereby the formation of layers of considerable thickness which might entail undesirable irregularities.

These and other objects and advantages as well as further characteristic features of this invention will become apparent from the following detailed description of a preferred embodiment and the appended drawing, showing in

FIG. 1 a vertical sectional view of a mixing machine for two constituent substance components along the line I—I in FIGURE 2, and in

FIG. 2 a horizontal cross-sectional view of the mixing machine along the line II—II in FIGURE 1.

In the embodiment represented in FIGURES 1 and 2 the mixing machine includes a pedestal 1 on which a mixing chamber 2 is fixed. In the top-center of the chamber 2 having a circular, conveniently a cylindrical configuration, a feed hopper 3 is disposed. A rotor 4 is rotatably disposed in the chamber 2 and journaled in roller bearings 5. A motor 21 drives rotor 4 by means of a pulley 20 fixed on the motor shaft, a driving belt 19 and a pulley 18 fixed on the shaft of the rotor 4. A hollow worm 6 is provided at the opposite side of rotor 4 and extends upwardly into feed hopper 3. A feed pipe or other suitable duct means extends downwardly through the feed hopper and projects into the hollow shaft member of

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worm 6. In the upper-end zone of the hollow worm shaft the feed pipe 7 is provided with a sealing collar 8 surrounding the hollow worm shaft at its upper end. The feed pipe 7 is held in the center of the feed hopper 3 by means of a web structure 9. The hollow worm 6 is provided with two worm flights 10 and 10' while the space inside the hollow shaft forms a channel 11 communicating with impelling zones or tracks 13 of rotor 4 through outlet gates 12. Impeller track or zone 13 is defined by two rotor blades, the leading impeller vane 14 and the lagging impeller vane 15 disposed between two lateral rotor flanges, the upper rotor flange 16 and the lower rotor flange 17. A scraper blade 22 is also fixed on the rotor 4. A passage opening 23 connects the lower end zone of the hollow-shaft worm 6 and the central feed hopper 3 with two other impeller zones or tracks 24 disposed between and defined by the leading impeller vanes 14 and the scraper blades 22. The impeller rotor 4 is rotatably disposed in the chamber 2 leaving an annular mixing zone 25 of a trapezoidal cross-section defined by two radially converging lateral portions and a substantially cylindrical inner surface 26 of the mixing chamber wall. The scraper blades 22 are designed to fit into the cross-section of the annular mixing zone 25. A discharge opening 30 is arranged in the cylindrical wall of the mixing chamber 2.

The various pre-dosed mixture constituents, such as liquid 32 and powder 33 are fed separately through the worm flights 10, 10' of the hollow-shaft worm 6 and through the feed pipe 7 and the hollow-shaft feed channel 11 respectively, to the impeller rotor 4 which conveniently rotates at a relatively high speed. The mixture constituent fed through feed channel 11, for example, a liquid 32 flows through the outlet gates 12 into impelling tracks 13. The mixture constituent passing the flights of hollow-shaft conveyor worm 6 fed into feed hopper 3, for example a powder 33, enters the impelling tracks 24 through the passage openings 23. Under the influence of the centrifugal forces produced by the rotation of rotor 4 in the sense indicated by an arrow 31 both constituents the liquid 32 and the powder 33 are flung outwardly along the impeller vanes 14 and 15 forming thin films thereon which are consecutively sprayed, the powder 33 first and followed by the liquid 32, as thin layers onto the cylindrical wall surface 26. The particles of the constituents spreading over the entire width of the vanes 14 and 15 and reaching the lateral rotor flanges 16 and 17 flow further along the radially converging annular wall surfaces of the mixing chamber 25 onto the cylindrical wall surface 26, where uniform diffusion of the liquid into the powder layer takes place immediately. Soon after formation of the mixture the layer is peeled off by the scraper blades 22 following behind the impelling tracks and removed through the discharge opening 30.

The advantages of the arrangement described consist in the very high degree of fineness and uniformity of distribution of the constituent mixture components on a relatively large surface area on account of the high rotation speed of the rotor. The powder forming only an extremely thin layer on the large surface area enables a very rapid and uniform absorption of the liquid, so that a highly perfect mixture and therefore a very homogeneous product is obtained and available within a minimum of time for being further processed, for example in a kneader or the like.

Without departing from the spirit and the scope of this invention as defined by the appended claims it is of course possible to mix more than only two constituent mixture components by simply providing additional feed duct means and correspondingly additional impeller vanes and tracks on the rotor.

I claim:

1. A method of mixing two components of materials for example a liquid component and a granular component, comprising directing a first component at high force by centrifugally hurling it against a surface to form a thin layer on the surface, and thereafter directing a second component to the same surface and over the first component layer, and thereafter scraping the intermixed layers from the surface.

2. A method, according to claim 1, wherein the components are whirled at high centrifugal force outwardly against the surface one after the other.

3. A method of mixing two components of materials for example a liquid component and a granular component, comprising directing a first component at high force by centrifugally hurling it against a surface to form a thin layer on the surface, and thereafter directing a second component to the same surface and over the first component layer, and removing the intermixed layers from the surface by scraping the components off the surface immediately after they have been directed thereon.

4. A device for mixing two components of materials for example a liquid component and a granular component comprising a housing having a mixing chamber with a wall defining a mixing surface, a rotor rotatably mounted in said housing and located in said mixing chamber and having impeller means defining at least two serially acting and angularly spaced separate component flow paths terminating in separate peripheral discharges, and means to rotate said rotor to direct the components through the separate flow paths and to direct each component against the mixing surface at the separate peripheral discharges.

5. A device for mixing two components of materials for example a liquid component and a granular component comprising a housing having a mixing chamber with a wall defining a mixing surface, a rotor rotatably mounted in said housing and located in said mixing chamber and having impeller means defining at least two serially acting and angularly spaced separate component flow paths terminating in separate peripheral discharges, means to rotate said rotor to direct the components through the separate flow paths and to direct each component against the mixing surface at the separate peripheral discharges, and scraper means rotatable with said rotor for scraping the materials off said mixing surface.

6. A device for mixing two components of materials for example a liquid component and a granular component comprising a housing having a mixing chamber with a wall defining a mixing surface, a rotor rotatably mounted in said housing and located in said mixing chamber and a plurality of impeller blades defining at least two serially acting and angularly spaced separate component flow paths terminating in separate peripheral discharges, means to rotate said rotor to direct the components through the separate flow paths and to direct each component against the mixing surface at the separate peripheral discharges, and a scraper rotatable with said rotor for scraping the materials off said mixing surfaces.

7. A device for mixing two components of materials for example a liquid component and a granular component comprising a housing having a mixing chamber defined therein and a feed hopper connected downwardly centrally into said mixing chamber, a rotor rotatable in said mixing chamber and including a portion extending upwardly into said hopper, said rotor including a hollow central portion disposed within said hopper and extending downwardly to said mixing chamber and communicating at its lower end with said mixing chamber and provided for the flow of a first component of material therethrough, said rotor further including a screw conveyor portion extending into said feed hopper around said hollow central portion for delivering a second component of materials downwardly from said feed hopper into said mixing chamber, the portion of said rotor within said mixing

chamber including impeller means defining spaced flow paths for each component communicating with the respective screw conveyor and said hollow central portion for feeding each component separately from said feed hopper, said impeller means defining separate peripheral discharges for directing the components separately at spaced peripheral locations against the wall of said housing defining said mixing surface, and means to rotate said rotor to advance the components through the separate flow paths and to direct each component against the mixing surface at the separate peripheral discharges one after the other as said rotor is rotated.

8. A device for mixing two components of materials for example a liquid component and a granular component comprising a housing having a mixing chamber defined therein and a feed hopper connected downwardly centrally into said mixing chamber, a rotor rotatable in said mixing chamber and including a portion extending upwardly into said hopper, said rotor including a hollow central portion disposed within said hopper and extending downwardly to said mixing chamber and communicating at its lower end with said mixing chamber provided for the flow of a first component of material therethrough, said rotor further including a screw conveyor portion extending into said feed hopper for delivering a second component of materials downwardly from said feed hopper into said mixing chamber, the portion of said rotor within said mixing chamber including impeller means defining spaced flow paths for each component communicating with the respective means for feeding each component separately from said feed chamber, said impeller means defining separate peripheral discharges directing the components separately against the wall of said housing defining said mixing surface, means to rotate said rotor to advance the components through the separate flow paths and to direct each component against the mixing surface at the separate peripheral discharges one after the other as said rotor is rotated, and scraper means carried by said rotor for scraping the material from the mixing surface after the materials have been directed thereon by said impeller means.

9. A device for mixing two components of materials for example a liquid component and a granular component, comprising a housing defining a substantially cylindrical mixing chamber and an annular mixing wall surface, means defining a hopper extending downwardly into said mixing chamber, a rotor rotatable in said mixing chamber and having its periphery spaced inwardly from the said mixing surface, said rotor further including an upstanding central conduit portion for the delivery of a first component and an exterior worm defined around said conduit for delivering a second component from said hopper, said rotor further having spaced impellers defining separate curved passages extending outwardly for the separate peripheral discharge of each of said components, means defining a scraper between said impellers for scraping the materials off the mixing surface immediately after they are applied at the separate peripheral discharges by said impeller means to said mixing surface, means defining a discharge for the materials at one location around the periphery of said mixing surface, and means for rotating said rotor to direct the components to the separate flow paths from said feed hopper and to whirl them outwardly against the mixing surface at separate peripheral discharge locations one after the other.

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