July 2, 1963 J. R. ROSENLEAF 3,096,212

BLENDER BELT

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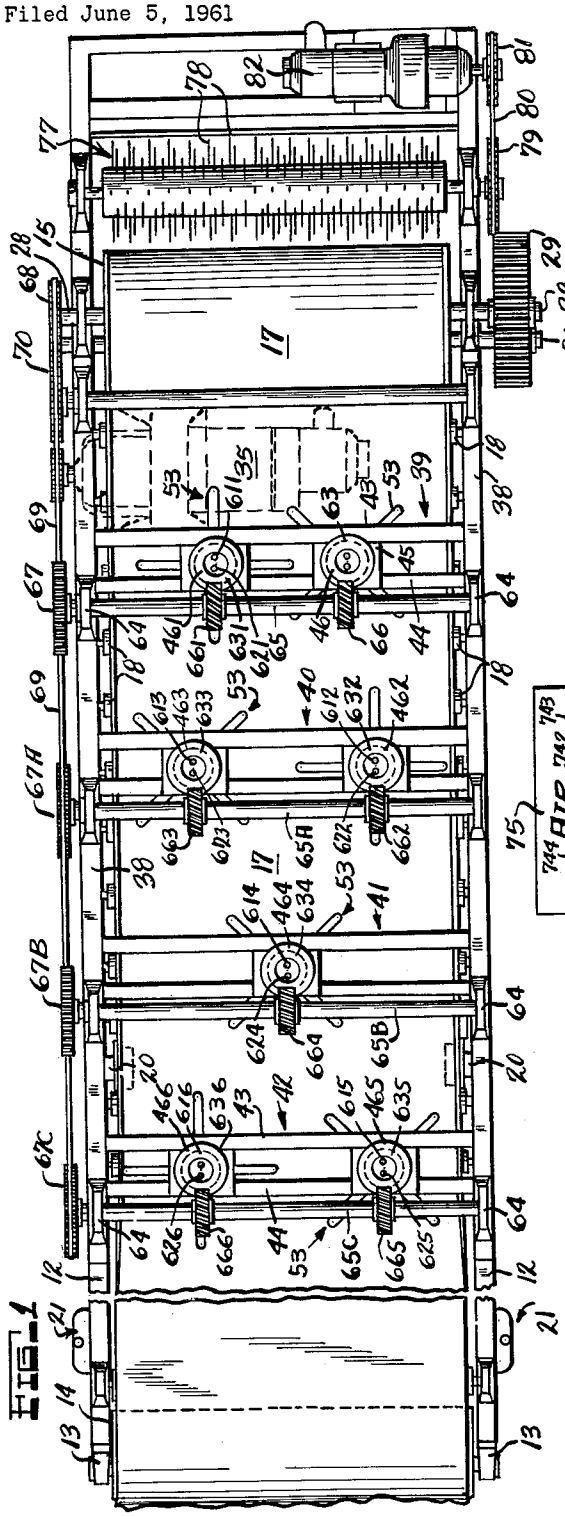


FIG. 1

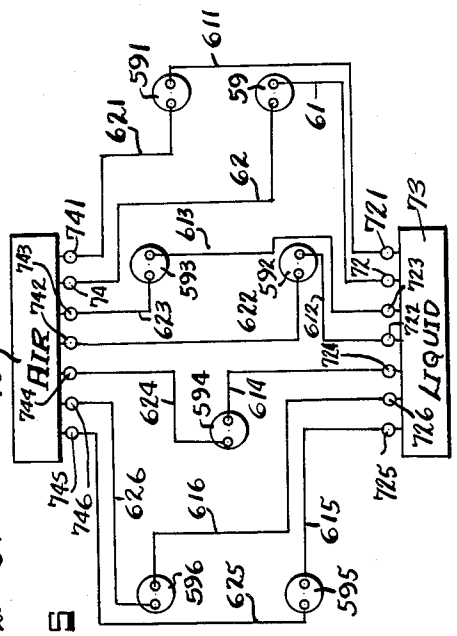


FIG. 5

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BLENDER BELT

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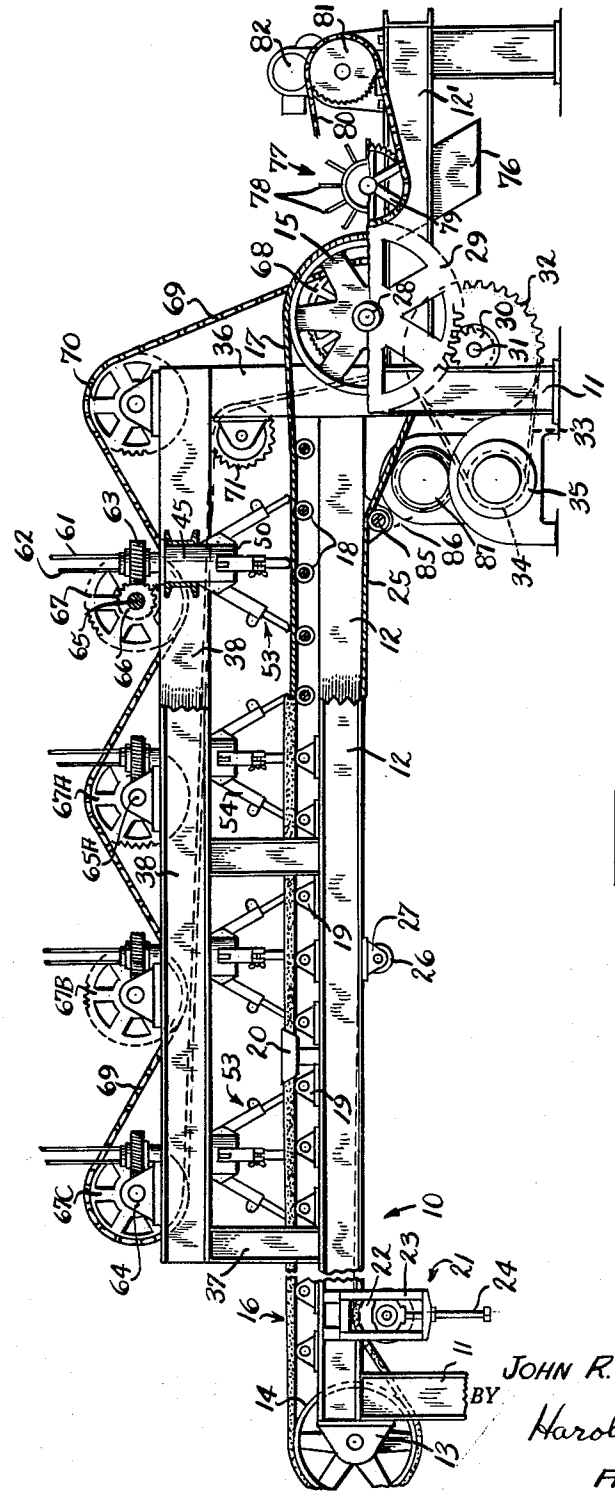


FIG. 2

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BLENDER BELT

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FIG. 3

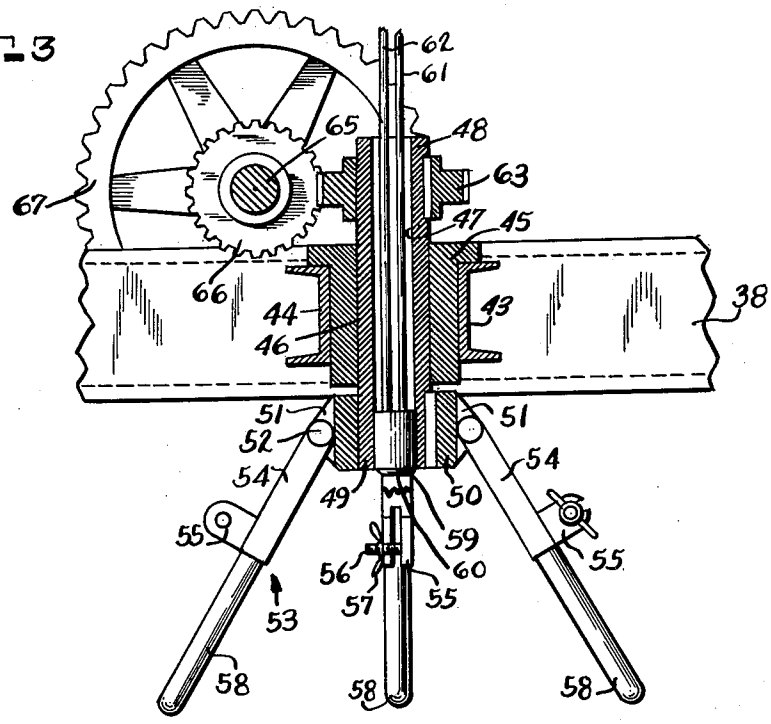
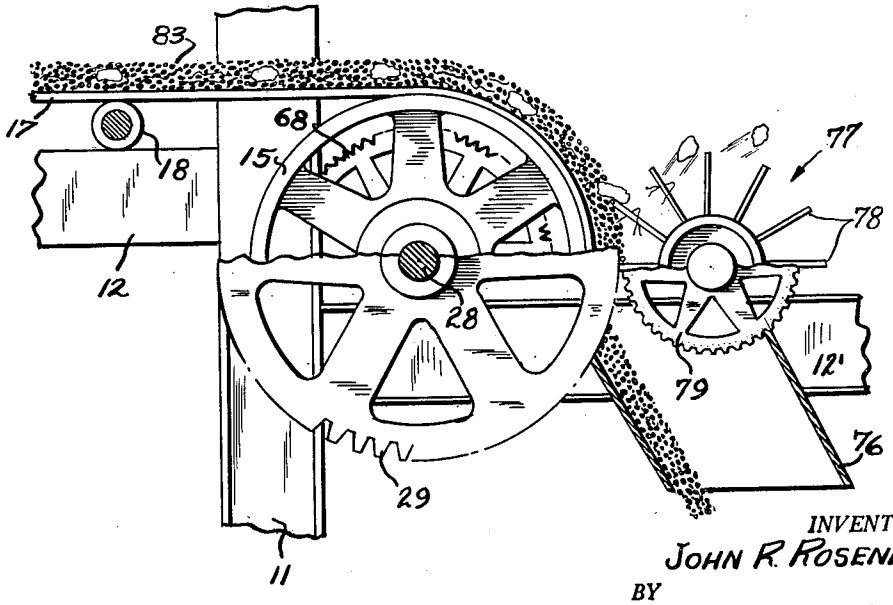


FIG. 4



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3,096,212

BLENDER BELT

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6 Claims. (Cl. 118—111)

The present invention relates to a blender belt, the primary function of which is to blend an originally-liquid binder uniformly through a moving mass of discrete material whereby the mass is delivered as a substantially-homogeneous mass of individually-coated, discrete particles arranged in a layer of substantially uniform dimensions. The binder is usually of a character which does not develop tackiness or cohesive qualities until it is subjected to a predetermined degree of heat.

A primary object of the invention is to provide a machine of the character above described including a plurality of agitators each of which comprises a plurality of moving fingers yieldably bearing upon a mass of material travelling past such agitators upon a moving conveyor, together with optimum means for controllably delivering a liquid binder to such mass in dispersed condition, such binder-delivering means preferably being directly associated with the several agitators.

A further object of the invention is to provide improved agitator means for use in the above described environment.

A still further object of the invention is to provide, in a machine of the character described, means directly associated with each agitator for delivering binder, in a dispersed spray, to the mass of discrete material as it moves past said agitators.

Still another object of the invention is to provide, in connection with a machine of the character described, means arranged at the delivery end of the machine for picking lumps, strings or foreign matter from the homogeneous mass to be delivered by the machine.

Further objects of the invention will appear as the description proceeds.

To the accomplishment of the above and related objects, my invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

FIG. 1 is a plan view of a machine constructed in accordance with the present invention;

FIG. 2 is a side elevation thereof, parts being broken away and parts being shown in section for clarity of illustration;

FIG. 3 is an enlarged sectional view of an agitator forming an element of my machine, and illustrating parts of the driving train therefor and the preferred mode of association of the binder-delivering means therewith;

FIG. 4 is an enlarged elevational view, partly in section, of one advantageous form of picker means which may be embodied in the machine; and

FIG. 5 is a diagrammatic illustration of the binder-delivery system and the control mechanism therefor.

In a number of commercial operations, it is desirable to produce a homogeneous mat or layer of granular, fibrous, pelleted or other forms of discrete material by thoroughly and substantially uniformly coating the individual particles of a mass of such material with a suitable binder, while spreading such material to a substantially uniform thickness and transverse dimension; and it is desirable, in such an operation, to produce the mat continuously rather than in a batch process. To that end, it is advantageous

to move such discrete material past a plurality of agitator means so constructed and arranged as to spread and stir the material as it is carried upon an endless conveyor and to apply binder to the material at several successive stages in its progress past the agitators. The agitating means, of course, must preferably be of such character as to work not only the exposed surface of the mass of material but the full thickness of such mass down to the surface of the conveyor means, yet it must not be of such character as substantially to impede the movement of the material with the conveyor or to damage the surface of the conveyor. I have found that it is highly advantageous, in such a process, to deliver the binder to the mass of discrete material directly adjacent the field of operation of each agitator means, and I have further found that, depending upon the character of the discrete material being treated, the proportion of binder applied to the material will preferably be varied as the material progresses past successive agitator stations.

Referring more particularly to the drawings in which I have illustrated one preferred form of machine embodying the above-outlined desirable characteristics, it will be seen that I have shown a frame indicated generally by the reference numeral **10** and comprising uprights **11, 11** supporting laterally spaced, longitudinally extending frame elements **12, 12**. Adjacent the inlet end of the machine, bearings **13, 13** are supported in alignment to provide a journal mounting for a rotary support **14**; and a similar rotary support **15** is journalled, adjacent the opposite end of the machine and upon a parallel axis to complete the mounting for an endless belt conveyor indicated generally by the reference numeral **16**. The upper run **17** of the conveyor **16** is preferably supported, substantially throughout its length, upon transversely-extending rollers **18** which are journalled in bearings **19, 19** suitably spaced along the lengths of the respective frame members **12, 12**. Preferably one or more belt trougher guides **20** will be mounted on each member **12** to produce at least a slight transverse dishing of the upper run **17** of the conveyor belt.

A belt tightener indicated generally by the reference numeral **21** comprises a roller **22** mounted for reciprocation in a frame **23** under the influence of a screw **24**, and bearing against the lower run **25** of the conveyor **16** adjacent the inlet end of the machine. In the illustrated embodiment of the invention, said lower conveyor run **25** is additionally supported by an idler roller **26** journalled in bearings **27** depending from the beams **12**.

As shown, the rotary support **15** is carried by a shaft **28** which spans a pair of supplemental side frame members **12', 12'** and to which is fixed, outboard from one side of the frame, a gear **29** meshing with a pinion **30** on a further transverse shaft **31**. The shaft **31** further carries, outboard at the other side of the machine, a sprocket **32** over which is trained a driving chain **33** which meshes also with a sprocket **34** on the output shaft of a motor-reducer assembly **35**. Thus, it will be seen that the shaft **28** is driven, from the motor **35**, at greatly reduced speed.

Upright extensions **36** and **37** at opposite ends of the main frame **10** carry a pair of longitudinally-extending side frame members **38, 38** which are disposed at a level significantly above the upper run **17** of the conveyor **16**. At a plurality of points longitudinally spaced along the lengths of the members **38**, I provide cross beams **39, 40, 41** and **42** spanning said members **38**, each cross beam preferably comprising a pair of channels mounted in spaced, back-to-back relation as indicated most clearly at **43** and **44** in FIG. 3.

Suitably supported between the channels **43** and **44** of the cross beam **39** is a bearing or bushing **45** mounted

upon a vertical axis; and a rotor 46 is journalled in the bearing 45 for rotation about its own vertical axis but supported in any suitable fashion against significant axial movement relative to the bushing 45. Said rotor is formed with an axial bore 47 therethrough and is so proportioned and designed as to include a portion 48 projecting upwardly beyond the bushing 45 and a portion 49 projecting downwardly beyond said bushing.

A collar 50 is mounted upon the lower end 49 of the rotor to turn therewith; and at peripherally spaced points, said collar is provided with radially projecting ears 51 supporting pivot pins 52 upon which are mounted agitator fingers indicated generally by the reference numeral 53. Each such finger, in the illustrated embodiment of the invention, comprises a sleeve-like element 54 which is split, at least adjacent its distal end, and carries mating tabs 55. A screw 56 is hingedly secured to one tab of each pair and is receivable in an open ended slot in the other tab of said pair, said screw carrying a wing nut 57 manipulable upon its screw to draw the tabs of each pair toward each other. An extension element 58 is telescopically received in each sleeve element 54 and is axially adjustable therein, each such extension element being securable in any desired position of adjustment by the clamping means 55–57.

It will be seen that the fingers 53 depend from their pivot pins 52 and are freely rockable thereon so that the distal ends of the extension elements 58 are yieldably biased downwardly by gravity. Preferably, the length of each finger 53 is so adjusted that, when the machine is static, the distal ends of the fingers rest upon the upper run 17 of the conveyor substantially in the angular relationship illustrated in FIG. 2. Quite obviously, if the length of each finger 53 is reduced beyond that illustrated, the fingers will depend at a more acute angle to the vertical and if the length of the fingers is increased, they will depend at a less acute angle to the vertical. It is found that this angle may desirably be varied depending upon the character of the material being handled and upon the character and design of the fingers, the distal ends of which may be part-spherically rounded as shown or may be formed to provide plow blades or scrapers or any other desired shape.

A spray nozzle 59 is so mounted in the lower end of the bore 47 that it does not partake of the rotation of the rotor 46, its delivery mouth 60 being directed downwardly toward the upper run 17 of the conveyor 16. A liquid supply tube 61 leads upwardly from the nozzle 59 through the rotor bore 47 and to a liquid reservoir 73 (FIG. 5); and an air supply tube 62 leads upwardly from the nozzle 59 through the rotor bore 47 and to a source 75 of air or other gas under pressure. A control valve 72 is interposed in the tube 61 and a control valve 74 is interposed in the tube 62, said valves preferably being needle valves disposed closely adjacent the reservoirs 73 and 75, respectively.

Fixed to the upper end 48 of the rotor 46 is a helical gear 63. Aligned bearings 64 supported upon the upper surfaces of the frame members 38, 38 provide a journal mounting for a shaft 65 upon an axis transverse to the length of the frame and closely adjacent the axis of the rotor 46. A helical gear 66 on the shaft 65 meshes with the helical gear 63 to provide a driving connection between the shaft 65 and the rotor 46. A sprocket 67 is carried on the shaft 65 outboard with respect to the frame 10.

Similar shafts 65A, 65B and 65C are similarly mounted upon parallel axes adjacent the cross beams 40, 41 and 42, respectively; and those shafts carry sprockets 67A, 67B and 67C, respectively, disposed in a common plane with the sprocket 67. A sprocket 68 is carried on the shaft 28, likewise in said common plane; and an endless drive chain 69 is trained about the sprocket 68, over an idler sprocket 70, under the sprocket 67, over the sprocket 67A, under the sprocket 67B and over the sprocket 67C, and thence back, over an idler sprocket 71, to the sprocket 68. It will be obvious that the sprocket 68 rotates with the rotary support 15 and that the chain 69 drives the shafts 65A and 65C in the direction of rotation of the rotary support 15 and drives the shafts 65 and 65B in the opposite direction.

Other agitator assemblies identical with that illustrated in FIG. 3 are suitably supported from the several cross beams in a suitable arrangement to accomplish effective working and spreading of the mass of material moving through the machine. I have illustrated what I presently consider to be an optimum arrangement of such agitator assemblies. Thus, as shown in FIG. 1, the rotor 46 is somewhat offset to the right from the median line of the conveyor 16 while another rotor 461 is correspondingly offset to the left of that median line and is supported upon the beam 39. The upper end of the rotor 461 carries a helical gear 631 meshing with a helical gear 661 on the shaft 65 so that the rotors 46 and 461 will be turned in a common direction at a common rate and in such relationship to each other that the fingers supported from the respective rotors will not interfere. A liquid line 611 connects the spray nozzle 591 within the rotor 461 with the reservoir 73 through a control valve 721, and a gas line 621 connects said nozzle with the reservoir 75 through a valve 741.

A rotor 462 is supported upon the beam 40 at a position still farther offset to the right from the median line of the conveyor and the upper end of said rotor carries a helical gear 632 meshing with a helical gear 662 on the shaft 65A. The spray nozzle 592 within the rotor 462 is connected by a liquid line 612 to the reservoir 73 through a control valve 722 and said nozzle is connected by a gas line 622 to the reservoir 75 through a control valve 742.

Similarly offset to the left and supported upon the beam 40 is a rotor 463 carrying a helical gear 633 which meshes with a helical gear 663 on the shaft 65A; and the nozzle 593 within said rotor 463 is connected by liquid line 613 with reservoir 73 through control valve 723 and is connected by gas line 623 with reservoir 75 through control valve 743.

The beam 41 supports a rotor 464 substantially upon the median line of the conveyor, and the upper end of said rotor carries a helical gear 634 meshing with a helical gear 664 on the shaft 65B. The nozzle 594 within the rotor 464 is connected by liquid line 614 with the reservoir 73 through a control valve 724 and is connected by gas line 624 with the reservoir 75 through a control valve 744.

A rotor 465 is supported from the beam 42 substantially in line with the rotor 462 and is driven by a helical gear 665 carried by the shaft 65C and meshing with a helical gear 635 on said rotor. The spray nozzle 595 within the rotor 465 is connected by a liquid line 615 with the reservoir 73 through a control valve 725 and is connected by a gas line 625 with the reservoir 75 through a control valve 745. A rotor 466 is supported on the beam 42 substantially in line with the rotor 463 and carries a helical gear 636 meshing with a helical gear 666 on the shaft 65C. The spray nozzle 596 associated with the rotor 466 is connected by liquid line 616 with the reservoir 73 through a control valve 726 and is connected by a gas line 626 with the reservoir 75 through a control valve 746.

In operation, the reservoir 73 is charged with a suitable liquid binder and the valves 721, 72, 723, 722, 724, 726 and 725 are individually adjusted to determine the rate of flow of binder to the several spray nozzles of the organization. The reservoir 75 is charged with air or other gas under predetermined pressure and the valves 741, 74, 743, 742, 744, 746 and 745 are individually adjusted to determine the rate of flow of air to the respec-

tive spray nozzle. Suitable means (not shown) will be provided to maintain working pressure in the reservoir 75.

Now, the motor 35 will be energized to drive the rotary support 15 in such a direction as to cause the upper run 17 of the conveyor belt 16 to move at a predetermined rate from the left toward the right as viewed in FIG. 2. In the manner described above, the several agitator assemblies will be correspondingly driven, the agitators supported from alternate ones of the beams 39, 40, 41, and 42 being driven in opposite directions. Discrete material is fed to the conveyor 16, either manually or by any suitable power feed means, adjacent the left hand end of the machine as viewed in FIG. 2 and will be carried past the several agitator assemblies. As the material reaches the assemblies carried on the beam 42, binder will be sprayed thereon at a suitable rate, and the material will be mixed, kneaded and spread by the coaction of the fingers supported from the rotors 465 and 466. As that material reaches the zone of action of the agitator assembly supported from the beam 41, a further quantity of binder will be sprayed thereon and the fingers carried by the rotor 464 will further agitate and mix the material. Still further binder will be added to the material, at a rate to be determined by experience, at the zones of the beams 40 and 39, and the material will there be further kneaded, mixed and spread.

It is of importance that the distal ends of the fingers 53 of each of the agitator assemblies are urged toward the belt only by gravity. Thus, the finger tips will follow the dishing of the belt as the agitators rotate and will continue to knead, agitate and distribute the mass to ensure complete and uniform coating of the individual particles of the discrete mass as that mass moves past the several ranks of agitators; yet the fingers are free to yield upwardly if their tips encounter hard lumps or foreign material within the mass. While effective homogenization of the mass is accomplished, the hazard of damage to the belt, or even excessive wear thereof, is obviated.

I prefer to provide a discharge chute 76 adjacent the delivery end of the conveyor 16. The mass of coated, discrete material will be discharged through said chute, usually to another conveyor onto which it will be distributed in a layer of substantially uniform thickness. With some materials and some binders, there may be a tendency to form lumps within the mass, and sometimes foreign materials find their way into the mass. Therefore, it may be desirable to provide picker means; and to that end, I have illustrated one suitable form of picker means indicated generally by the reference numeral 77. As shown, such means comprises a picker wheel journalled upon an axis transverse with respect to the frame and provided with a series of radially-projecting picker fingers 78 of uniform radial length. The wheel may be mounted in any suitable fashion for adjustment toward and away from the surface of the conveyor 16 as it passes over the support 15; but since such means for adjusting the position of an axis is well known, it has not been deemed necessary to illustrate it. Ordinarily, the picker wheel will be so positioned that the tips of its fingers just clear the moving belt 17. A sprocket 79 is drivingly associated with the picker wheel and a chain 80 is trained over said sprocket and over a sprocket 81 driven by a motor 82 to rotate the picker wheel in the direction of rotation of the rotary support 15. The action of the picker wheel will be obvious and is suggested in FIG. 4. As the finished mat 83 follows the belt 16 about the periphery of the support 15, the upwardly travelling fingers 78 of the picker wheel move through the falling mass of material being discharged to the chute 76 and, striking any lumps, strands or foreign matter, tend to remove them from the mass.

In order to clean the material-carrying surface of the belt 16, I preferably mount a wiper shaft 85 on the lower surface of the frame and pass the lower run 25 of the belt over that shaft. A chain 86 provides a driving connection between a sprocket on the shaft 85 and a sprocket 87 on the output shaft of a reducer driven by the motor 35, to turn the shaft 85 in a clockwise direction.

I claim as my invention:

1. In a device of the class described, a travelling conveyor for discrete material, and a plurality of agitators spaced along the path of said conveyor in the direction of conveyor travel, each such agitator comprising a rotor suspended above said conveyor for turning movement about a vertical axis, a plurality of arms carried by each rotor, each arm being pivotally supported from its rotor for relative movement about a substantially horizontal axis and said arms for each rotor being peripherally spaced about said vertical axis, each of said arms depending from its pivotal support and having a length greater than the vertical distance from its pivotal support to said conveyor, a spray nozzle concentrically associated with at least one of said rotors and arranged to discharge toward said conveyor, and means for driving said rotors during transit of said conveyor.

2. The device of claim 1 in which said means for driving said rotors turns alternate rotors in opposite directions.

3. The device of claim 1 in which each arm comprises a pair of telescopically-associated elements and clamping means for securing said elements in any desired position of relative telescopic adjustment.

4. In a device of the class described, an elongated frame, rotary support means mounted on longitudinally-spaced axes extending transversely of said frame, an endless conveyor trained over said support means and operatively connected to be driven thereby, a pair of longitudinally-extending side frame members supported above the upper run of said conveyor, a plurality of cross beams spanning said side frame members and spaced longitudinally therealong, a bearing member supported on a substantially vertical axis from each of said cross beams, a tubular rotor journalled in each bearing and projecting upwardly and downwardly therefrom, a shaft arranged on an axis transverse with respect to said frame adjacent each cross beam, each shaft being supported from at least one of said side frame members, a helical gear on each rotor above its associated bearing, a helical gear on each shaft meshing with the gear on an adjacent rotor, a collar fixed to each rotor below its associated bearing, a driven sprocket drivingly supported on each shaft, a driving sprocket operatively connected to be driven with said rotary supports, an endless chain trained over said driving sprockets and meshing oppositely with the driven sprockets on alternate ones of said shafts, a spray nozzle supported within each rotor and arranged to discharge downwardly therefrom toward said conveyor upper run, a plurality of agitator arms pivotally mounted on each collar in a perimetral series for individual oscillation about substantially horizontal axes and depending therefrom substantially into engagement with the upper run of said conveyor, and means operatively connected to drive at least one of said rotary supports.

5. In a device of the class described, an elongated frame, rotary support means mounted on longitudinally-spaced axes extending transversely of said frame, an endless conveyor trained over said support means and operatively connected to be driven thereby, a pair of longitudinally-extending side frame members supported above the upper run of said conveyor, a plurality of cross beams spanning said side frame members and spaced longitudinally therealong, a bearing member supported on a substantially vertical axis from each of said cross beams, a tubular rotor journalled in each bearing and projecting upwardly and downwardly therefrom, a shaft arranged on an axis transverse with respect to said frame adjacent each cross beam, each shaft being supported from at least one of said side frame members, a helical gear on

each rotor above its associated bearing, a helical gear on each shaft meshing with the gear on an adjacent rotor, a collar fixed to each rotor below its associated bearing, a driven sprocket drivingly supported on each shaft, a driving sprocket operatively connected to be driven with said rotary supports, an endless chain trained over said driving sprockets and meshing oppositely with the driven sprockets on alternate ones of said shafts, a spray nozzle supported within each rotor and arranged to discharge downwardly therefrom toward said conveyor upper run, a plurality of agitator arms pivotally mounted on each collar in a perimetral series for individual oscillation about substantially horizontal axes and depending therefrom substantially into engagement with the upper run of said conveyor, means operatively connected to drive at least one of said rotary supports, a liquid supply line for each spray nozzle extending upwardly therefrom to the outside of the associated rotor and leading to a source of liquid, a gas supply line for each spray nozzle extending upwardly therefrom to the outside of the associated rotor and leading to a source of gas under pressure, and an individual valve means for each of said lines to control the rate of fluid flow therethrough.

6. In a device of the class described, a travelling conveyor for discrete material, and a plurality of agitators spaced along the path of said conveyor in the direction of conveyor travel, each such agitator comprising a rotor

suspended above said conveyor for turning movement about a vertical axis, a plurality of arms carried by each rotor, each arm being pivotally supported from its rotor for relative movement about a substantially horizontal axis and said arms for each rotor being peripherally spaced about said vertical axis, each of said arms depending from its pivotal support and having a length greater than the vertical distance from its pivotal support to said conveyor, a spray nozzle concentrically associated with at least one of said rotors and arranged to discharge toward said conveyor, and means for driving said rotors during transit of said conveyor, and driven picker means arranged adjacent the discharge end of said conveyor, said picker means including a multiplicity of fingers moving constantly through the mass of material being discharged from the machine in a direction counter to the flow of such material.

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