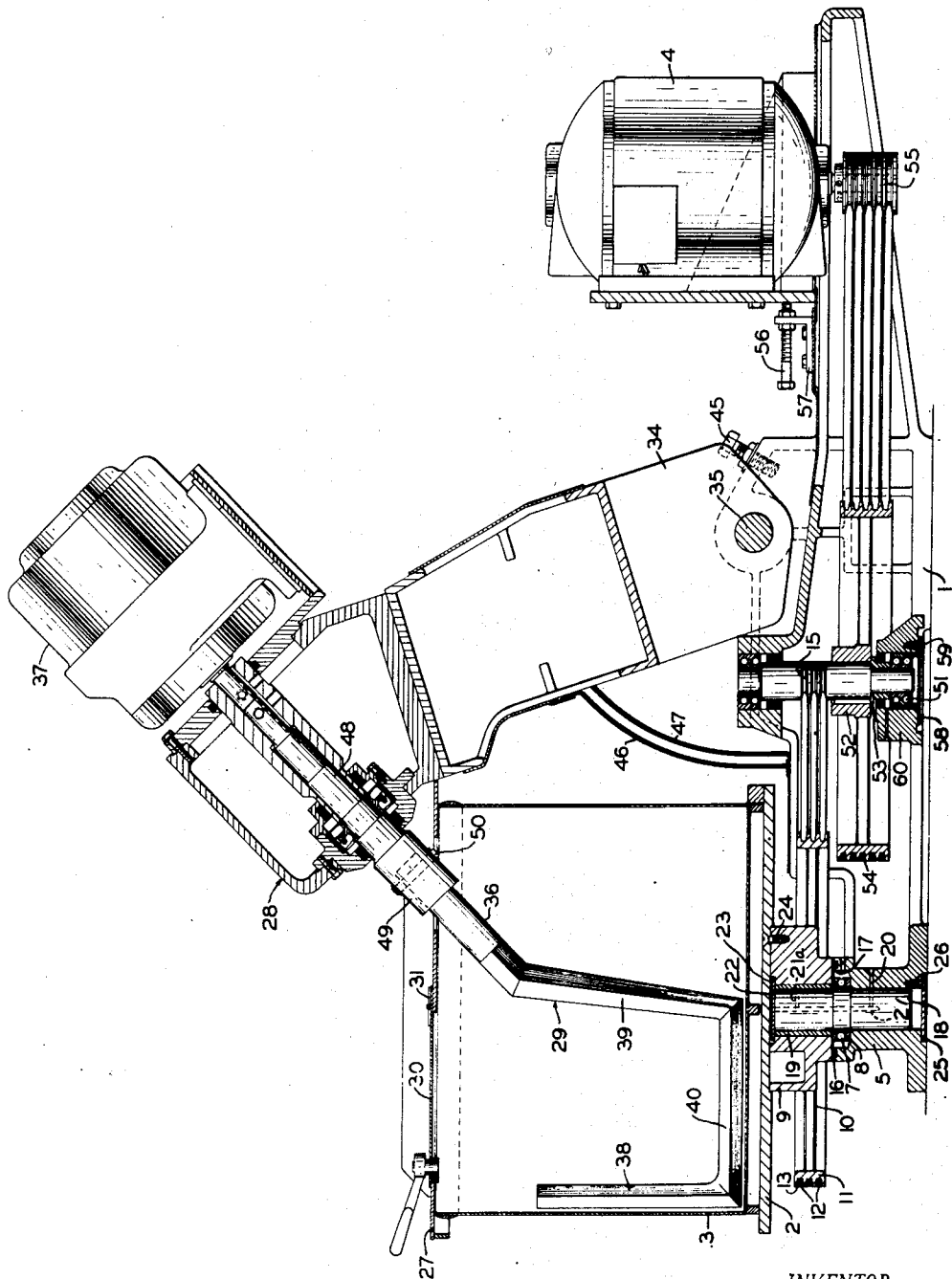


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M. B. NICHOLLS
APPARATUS FOR MIXING FINELY DIVIDED
SOLID PARTICLES AND LIQUID
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INVENTOR.
MALCOLM B. NICHOLLS

BY
Clarence B. Desjardins
HIS ATTORNEY

UNITED STATES PATENT OFFICE

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APPARATUS FOR MIXING FINELY DIVIDED
SOLID PARTICLES AND LIQUID

Malcolm B. Nicholls, Cincinnati, Ohio, assignor to
Troy Engine and Machine Company, Troy, Pa.,
a corporation of Pennsylvania

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This invention relates to a method of mixing and a mixer for combining finely divided solid materials with a liquid vehicle to form an intermixed mass, and it particularly pertains to mixing the components of a batch more thoroughly an intimately into a homogeneous mass and carrying out the mixing operation without creating any objectionable amount of dust from the finely divided solid material which is being mixed with the liquid vehicle.

In mixing finely divided solid particles with a liquid vehicle, such as in making paints, inks and like mixtures, it has been the common practice to place the finely divided solid material in a container, rotatable or stationary, and then rotate a mixing blade or blades within the container until the contents are mixed together. As a result of this operation, all the solid particles in the batch are stirred and agitated throughout the mixing operation, including those which are remote from the liquid vehicle as well as those which are next to it, so that many of the finer particles of the batch escape without being entrapped by the liquid in the mixed mass. This condition is not only objectionable because of loss of material, filling the air with the fugitive dust particles and dirtying the machinery, but it interferes with other batches being or to be mixed and affects their color so that the colors of the different colored batches are difficult to control and cannot be regulated with any degree of accuracy even by first carefully cleaning the machinery and waiting for the dust to settle out of the atmosphere.

In the present invention, however, the mixing operation is mainly carried out beneath the exposed surface or at the bottom of the batch, within the container, with only minimum agitation of any of the exposed solid particles so that substantially all agitation before entrapment of the solid particles by the liquid is confined beneath the exposed surface of the batch within the container where the solid particles are next adjacent to the side and bottom walls of the container near the liquid and are confined against escape. Only those particles of the solid material are agitated which are below the exposed surface, and the agitation progresses by circumferentially moving the solid material about the liquid core in which the mixer blade is stationary. This result is obtained by first placing the liquid vehicle in the container beneath the finely divided solid particles, rotating the container relatively to a non-

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driven mixing blade, or blades, which is immersed within the batch contents until the blade, or blades, is rotated by the drag of the mixed portion of the batch, and then power driving the blade, or blades to complete the mix. As a result of this method, essentially all agitation of the solid particles is beneath the exposed part of the batch, and the exposed part of the solid particles in the batch is not agitated until after nearly all of the particles have been entrapped in the mixture by the liquid vehicle. Then, the mixing blade, or blades, is power driven sufficiently to counteract the pull by the mixed mass until all of the finely divided particles have been incorporated into the mixture. By this mixing operation, generation of dust is practically eliminated and the ingredients are more intimately commingled than when the mixing blade is rotating with the container at the beginning of the mixing operation.

One of the principal objects of my invention is to mix a batch of finely divided solid particles with a liquid vehicle without permitting any substantial amount of the finely divided particles escaping entrapment by the liquid vehicle.

Another object of the invention is to mix a batch of finely divided solid particles with a liquid vehicle with a minimum agitation of the exposed finely divided particles.

Another object of the invention is to mix a batch of finely divided solid particles with a liquid vehicle by mixing the solid particles into the liquid progressively from the bottom to the top of the batch.

Another object of the invention is to circumferentially move the solid particles of a batch about the liquid with a nominally freely rotatable mixing blade projecting in the liquid.

Another object of the invention is to rotate a container, containing the batch, at the beginning of the mixing operation but not to rotate the mixing blade, or blades, projecting within the container and the batch, and to power drive the blade, or blades, at the end of the mixing operation only, and then mainly to counteract the drag upon the blade, or blades, by the mixed portion of the rotating batch.

Further objects and objects relating to the details of construction and economies of operation will definitely appear from the detailed description to follow. In one instance I have accomplished the objects of my invention by the device and means set forth in the following speci-

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fication. My invention is clearly defined and pointed out in the appended claims. A structure constituting a preferred embodiment of my invention and for carrying out the method is illustrated in the accompanying drawing forming a part of this specification in which the single figure is a cross-sectional view through the center of a machine embodying my invention.

Referring specifically to the drawings in which like numerals are used to designate like parts, there is an angular mixer having a base or bottom 1 with a rotatable turntable 2 rotatably mounted on one end on which a tub or container 3 may be placed. A motor 4 is mounted on the opposite end of the base with interposed driving mechanism between the motor and the turntable. The turntable is rotated by the motor by means of any suitable power transmission mechanism. There is a pedestal 5 provided on the base for rotatably supporting the turntable 2. An anti-friction bearing 7 is interposed between the ledge 8 on the top of the pedestal and the bottom end of the hub member 9 which is between the top of the pedestal and the turntable. A driven pulley 10 is attached to the hub member, and is preferably provided on the periphery of its rim 11 with a plurality of annular V-shaped grooves 12, each receiving a power transmission belt 13 which is connected to a similar groove in shaft 15. A sealing ring or gasket 16 is inserted between an annular groove formed in the top of the pedestal, and the bottom of the hub member for sealing a fluid within the chamber 17, surrounding the anti-friction bearing.

A jack shaft 18 is fitted in the pedestal with its upper end projecting into the central bore of the hub member 9 in which a sleeve 19 is placed to be interposed between the hub member and the upwardly projecting end of the jack shaft. There is a radial bore 20 having a grease gun fitting therein whereby a grease gun may be employed for injecting a lubricant into the longitudinal bore 21 in the jack shaft which connects with a radial bore or bores 21a leading to the bearing surface between the sleeve and the shaft for lubricating the bearing. The open end of the lubricating duct is covered by a plate 22 that seats within a recess 23 which is formed at the top of the hub member. The turntable seats on the pedestal and can be secured thereto by any suitable fastening means such as screw 24. A closure plate 25 is seated within a recess that is formed in the bottom of the pedestal and is held in place by screws 26, closing the end of the bore for the jack shaft. The invention is not limited to any particular driving mechanism between the motor and the turntable for rotating the container or tub on the turntable.

The container or tub 3 is seated upon the turntable with its open end up in position to be closed by a lid or cover 27 which is associated with the mixer unit 28 that is adapted to be raised or lowered for withdrawing the mixing blade 29 from the container or projecting it therein. In order that the operator of the machine may view the mixture inside the container without removing the lid, a slight opening is provided in said lid having a cover plate 30 hinged at one end at 31 and having a latch 32 at its other end. The mixer unit is attached to a support 34 that is pivoted to the base at 35. The tank lid or cover is also attached to the support 34 and will be moved on and off the top of the container or tub when the mixer unit is moved to have the mixing blade 29 projected in or withdrawn from the con-

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tainer or tub. The mixer unit comprises a spindle 36 driven by motor 37 which is attached to the support 34, the spindle having mounted on its bottom end a substantially U-shaped blade 29 having a pair of side arms 38 and 39 which are connected, by a bottom portion 40, to each other with the part 38 vertically disposed with its outer edge slightly spaced from the inside wall of the container or tub and the portion 40 horizontally disposed with its bottom edge slightly spaced from the bottom of the container or tub. The spindle 36 intersects the vertical axis of the container or tub substantially coincident with or above the center point at the level of the batch of the material which is placed within the container or tub. The vertically disposed arm 38 is of a length substantially less than the height of the batch so that its top end will terminate short of and be confined below the level of the batch. Accordingly, the agitation of any exposed material within the container or tub will be limited to that which is around the spindle where it projects into the batch, and since the intersection of the spindle and the vertical axis of the container is coincident with or above the center point at the level of the batch, the exposed particles at this point will not be stirred up but very slightly, if at all. The spindle from the point at and below which it contacts the batch ingredients is substantially coincident with the vertical axis of the container. The spindle with the blade thereon can be driven by the motor 37 which is mounted on the support 34, but it is not driven thereby at the beginning of the mixing operation of the batch but only after the batch or a substantial part thereof has been sufficiently mixed into a conglomerate viscous mass sufficient to cause the spindle to rotate with it as a result of the rotational movement of the mass.

The spindle can be power driven sufficiently to counteract the drag exerted upon the blade by the rotating mixed mass. At this stage of the mixing operation, most of the solid particles have been entrapped and the rotation of the spindle does not agitate any great amount of exposed entrapped particles.

The support 34 can be turned about the pivot 35 by a hand-wheel which is connected to suitable conventional worm gearing (not shown) for moving the support on and off the container. A stop screw 43 may be fitted to the support in position to abut against some fixed part of the base when the support is swung back to remove the mixer from the tub or container. A shield can be provided between the movable support and the base to keep the driving mechanism covered, and this shield may comprise one part 46 movable with the support and another part 47 fixed to the base. The two parts of the shield are disposed adjacent each other in parallel relation so that they will overlap each other at all times.

The mixing spindle is preferably detachably connected to the motor driven chuck shaft 48 by having its end fitted into the socket 49 in one end of the chuck shaft and held by a pin 50 which is projected through the spindle and the chuck shaft. Accordingly, the mixing spindle may be readily detached and attached to the chuck shaft.

The shaft 15 is journaled in bearings 51 in the base and has a pulley 52 keyed thereto at 53, the periphery of the pulley 52 being grooved with a plurality of grooves to receive transmission belts 54 that connects said pulley to a pulley 55 which is on the shaft of the motor 4. The motor 4 is

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adjustably mounted upon the base and may be adjusted by screw 56 that is fitted to the angle member 57 fixed to the base. The bottom end of the shaft 15 is closed by a plate 58 screwed threaded at 59 to the mounting 60 for one of the bearings.

In carrying out my invention a tub or container is placed on the turntable with a batch of ingredients placed therein. The liquid vehicle is first placed in the tub or container, and the finely divided solid particles are placed on top of the liquid vehicle. The mixer unit is moved for the blade on the end of the spindle to be projected in the tub or container and be immersed in the batch with the cover or lid closing the top of the tub or container. The arms of the mixing blade are disposed to be adjacent the side and bottom walls of the tub or container. The turntable is driven to rotate it and the container or tub thereon, but the blade on the spindle projecting into the container into the batch is not driven. Accordingly, all agitation of the batch is at the bottom of the tub or container beneath the exposed surface of the batch where all the liquid vehicle is concentrated and the solid particles are confined. By not rotating the blade at the beginning of the mixing operation, the finely divided particles are not agitated at the exposed surface of the batch, and all of them will be entrapped by the liquid vehicle without allowing any substantial quantity to escape. Furthermore, for some apparent reason more intimate mixing of the ingredients is obtained inasmuch as a batch mixed by this method needs to be run through a grinding mill for the final mixing operation only about twice rather than about four or five times as heretofore where the batch has been mixed by power driving both the blade and the tub or container simultaneously throughout the mixing operation. It is not apparent why a more intimate and better preliminary mix is obtained by my method, but one theory is that the liquid and solid particles are more closely brought into contact without violent agitation and with a more constant and uniform rubbing effect therebetween to better wet the solid particles, whereas with both the blade and the container or tub being rotated at the beginning of the mixing operation, the ingredients are too violently agitated to permit all of the individual solid particles being wetted with the liquid vehicle. Whatever may be the reason, it is a known fact that a more intimate mixing of the ingredients is not only obtained but the mixing is effected with a minimum of agitation of the finely divided solid particles at the exposed surface of the batch until after all of them have been wetted by the liquid vehicle and entrapped in the mixed mass.

As the ingredients of the batch become well mixed into a homogeneous mixed mass while being rotated, a drag is exerted upon the blade, causing it and the spindle to be rotated, and this rotational pull is increased as the whole batch becomes intermingled into a conglomerate viscous mass. When the freely rotatable spindle carrying the mixing blade begins to be rotated by the mixed batch in the rotating container, the spindle can then be power driven to complete the mixing operation. While the blade is being rotated by the pull of the rotating mixed mass, obviously there is less resistance or drag by then power driving the spindle than if it was not power driven and left free. Therefore, power driving the spindle at this stage of the mixing operation

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continues this even uniform spread of the ingredients and wetting of the solid particles until intermingling of the solid finely divided particles and the liquid vehicle has been substantially complete and all the solid particles are entrapped in the liquid. Power driving the mixer at this time speeds up the final phase of the mixing operation and cooperates as to conglomerate all the ingredients without unnecessary and objectionable agitation of the solid particles as would result by power driving the spindle at the beginning of the mixing operation.

I am aware that the structure shown herein and that the method described are susceptible of considerable variation without departing from the spirit of my invention and therefore I have claimed my invention broadly as indicated in the appended claims.

Having thus described my invention, what I claim as new and useful and desire to secure by United States Letters Patent, is:

1. A mixing machine comprising a rotatable turntable on which a container is adapted to be rotated, power transmission means for rotating the turntable, a freely rotatable spindle mounted upon an adjustable support, an angular blade fixed to the end of the spindle in position to be moved in and out of the container by adjustment of the support, said blade having one portion disposed parallel to the sidewall of the container and slightly spaced therefrom and another portion disposed parallel to the bottom wall of the container and slightly spaced therefrom, both of said portions of the blade terminating below the surface level of a batch of materials to be mixed in the container, and a separate power transmission means for the spindle.

2. A mixing machine as set forth in claim 1 in which the spindle is angularly disposed and intersects the vertical axis of the turntable above the center of the batch level.

3. A mixing machine comprising a support on which a container is adapted to be rotated, power transmission means for rotating the container, a freely rotatable spindle mounted upon an adjustable support, an angular blade fixed to the end of the spindle in position to be moved in and out of the container by adjustment of the support, said blade having an arm portion disposed to be slightly spaced from the sidewall of the container and another arm portion disposed to be slightly spaced from the bottom wall of the container, both of said arm portions of the blade terminating below the surface level of a batch of materials to be mixed in the container, and the blade being connected to the spindle at about the vertical axis of the container, and power transmission means for rotation of the spindle at will.

4. A mixing machine as set forth in claim 3 in which the connection between the blade and the spindle, above the surface level of the batch, is substantially coincident with the vertical axis of the container.

5. A mixing machine comprising a rotatable support for a container, a container mounted upon said support, means for rotating the support with the container thereon, a spindle journaled in a support and mounted for freely rotating therein with one end in a vertical plane common to the vertical axis of the container and projecting into the container below the surface level of a batch of materials placed within the container to be mixed, a blade fixed to the end of the spindle which projects within the con-

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tainer, and means for rotating at will the normally freely rotatable spindle.

6. A mixing machine as set forth in claim 5 in which the connection between the blade and the spindle, at the surface level of the batch, is substantially coincident with the vertical axis of the container.

MALCOLM B. NICHOLLS.

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