Feb. 5, 1952 I. M. E. AITKEN 2,584,525

MIXING MACHINE

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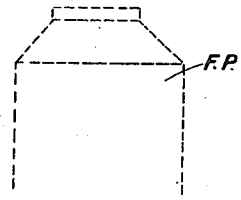



FIG. 1.

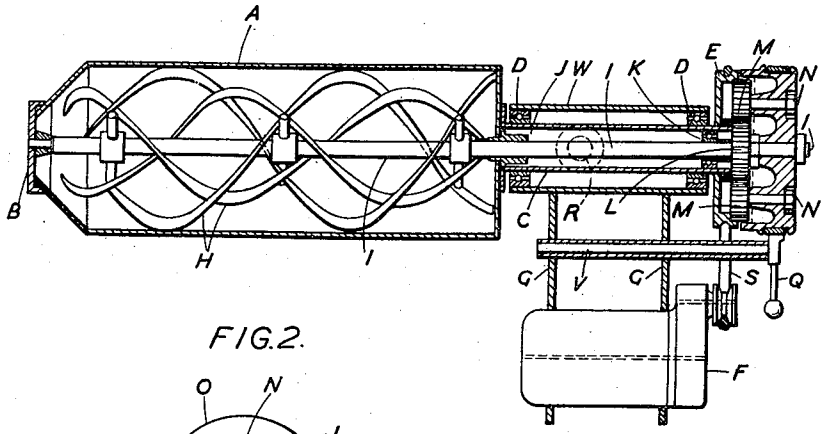
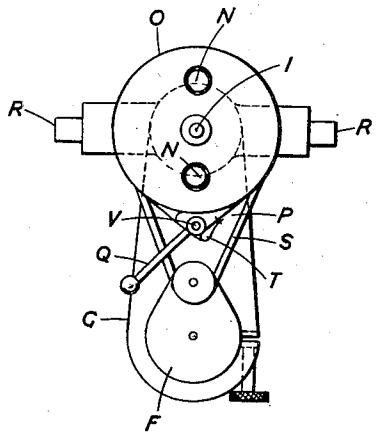
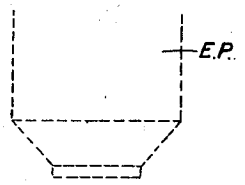



FIG. 2.




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## MIXING MACHINE

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5 Claims. (Cl. 259—85)

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The present invention relates to machines for intimately mixing or blending ingredients of mixtures together, particularly when in powder or comminuted form, to obtain a thoroughly homogeneous product.

Hitherto mixing machines of this kind have been of two main types. In one type the mixing takes place in a stationary vessel or hopper, in which is disposed a vane, paddle, or blade structure which is rotated about a horizontal or vertical axis from which the vanes, or the like, project or radiate. In the second type, the mixing is effected in a vessel or drum which is rotatable about a horizontal axis, so that the ingredients are tumbled as the vessel rotates. To enhance the tumbling action it is a common practice to provide vanes or blades fixed to the interior of the vessel or drum, and further to improve the mixing action, loose objects such as chains or balls are often placed in the drum.

The first type of machine has the disadvantage of requiring a very heavy starting torque when the vane structure is not started rotating before the vessel is fully charged with the ingredients, in consequence of which it is often necessary to set the vane structure in motion before the vessel is fully charged. Similarly if the vane structure is accidentally stopped, or has to be stopped for some special reason, before the mixing operation is completed, it may become necessary to unload some of the contents of the vessel before the vane structure can be started moving again to resume the mixing operation. Furthermore with this type of mixer there are likely to be unmixed pockets of the ingredients which escape the stirring action of the vanes or the like, due to their lodgment in recesses, such as discharge connections, or in other spaces which are not swept by the vanes or blades.

The main disadvantage of the second type of mixer is that it is very slow in action, in consequence of which a considerable time is taken to secure thorough admixture of the ingredients, although the mixing action is very efficient.

The object of this invention is to provide an improved mixing machine having the advantages of both of the above types of machine, without their disadvantages, and with this object in view the machine comprises a drum adapted to be rotated about a horizontal axis, and within said drum a paddle, vane, or blade structure adapted to be independently rotated about the same axis, whereby said drum and said structure may be rotated either with or without relative motion, as may be desired.

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The drum or casing may have a smooth interior, or it may have blades or vanes fixed thereto, and the driving mechanisms for the drum and vane structure may be such as to enable them to be rotated in the same direction or in opposite directions.

In order that the invention may be clearly understood and readily carried into practice it is illustrated, by way of example only, by the accompanying drawings, in which:

Figure 1 is a sectional diagram of a mixer constructed in accordance with the invention, and

Figure 2 is an end elevation thereof.

Referring to the drawings, the mixing machine comprises a mixing drum A open at one end but adapted to be closed by a removable cover B. At its closed end the drum A has an axial hollow spigot shaft C, running in ball bearings D, mounted in a cylindrical casing W which carries a frame structure comprising spaced plates G, supporting an electric motor F for driving the drum A. The drive is effected from the motor F, through reduction gearing incorporated in the motor casing, and a driving belt S, passing over a pulley E mounted on the hollow spigot shaft C.

At right angles to the axis of the drum A the casing W carries trunnions R which are supported by bearings in the fixed frame of the machine (not shown). By rotation about the trunnions R, the drum A can be disposed with its axis horizontal, as in Figure 1, in the running position, or it can be disposed with its axis vertical, either in its filling position FP with its end opening directed upwardly, when it can be charged on removal of cover B, or in its emptying position EP with its end opening directed downwardly, when if its cover B is removed, its contents can be discharged.

In addition to means for rotating the mixing drum A as described above, the machine also incorporates means for rotating a mixing rotor H within the drum A, when desired, at a variable and controlled speed in the reverse direction to that of the drum A.

The mixing rotor H comprises a spindle I supporting a plurality of helical blades or vanes by means of radial arms or spokes. The spindle I is journalled in suitable bearings at opposite ends of the drum A and at the closed end of the drum extends through the bearings, and through the hollow spigot shaft C and pulley E. At its end the spindle I is solidly coupled to a spur wheel L which forms the central pinion of a sun-and-planet type of epicyclic gear. The planet pinions M of the epicyclic gear are mounted on stub

shafts N projecting from the surface of a flanged disc O constituting the rotating carrier disc of the epicyclic gear. These planet pinions M mesh with the central gear L and also with internal teeth cut in a cylindrical flange projecting laterally from the side of the pulley E. The carrier disc O has peripherally a cylindrical lateral flange formed with radial lips or flanges defining a groove for an encircling brake band P. One end of the brake band P is anchored at T to a part fixed in relation to the frame GG by a tubular arm, constituting a bearing tube for a spindle V, on which is mounted a bell crank lever Q. The short arm of lever Q is anchored to the other end of the brake band P, so that by applying pressure to the handle of the lever Q the brake band P can be tightened about the rim of the carrier disc O.

The method of operation of the apparatus is as follows:

The mixing drum A is rotated about trunnions R until its axis is vertical and the drum is in its upper position FP. On removal of the cover B the ingredients to be mixed are loaded into the drum A and the cover replaced. The drum A is then again rotated about trunnions R into its horizontal running position and the motor F started, with the brake band P released.

The mixing drum A will then rotate and in doing so it will carry with it the vaned rotor H, due to the friction resulting from the presence of the ingredients to be mixed, the carrier disc O being free to rotate. After a few revolutions of drum A the mass of materials will be broken up by the tumbling action which takes place.

The brake band P is then gradually tightened, by operating lever Q, about the flange of carrier disc O, bringing the vaned rotor H gradually to rest, until finally it will commence to accelerate in the opposite direction to drum A, to its maximum speed, attained when the carrier disc O is held stationary by the brake band P. The actual relationship between the final speeds of the drum A and rotor H will depend upon the relative numbers of the teeth of the various wheels constituting the epicyclic gear.

On completion of the mixing process the electric motor F is stopped and the mixing drum A is rotated about trunnions R into its downwardly directed position EP with its axis vertical. The cover B is then removed, and the contents of the drum discharged into a hopper or container. If necessary the motor may be re-started, after removal of cover B, to facilitate such evacuation, either with, or without application of the brake band P to cause rotation of the vaned rotor H during the discharging process.

The initial mixing process in which the drum A and vane structure H rotate together, without relative motion, will not throw any excessive starting torque on the driving gear, since there will be little or no resistance to rotation of the whole mass in bulk. As soon as rotation starts, the gravitational action on the ingredients and the action of static friction will break up the mass of the ingredients by tumbling so that a relative motion can be initiated as between the vane structure and drum, which can be gradually increased by slowing down or speeding up one or other of them, without unduly increasing the driving torque.

It will be appreciated that the tumbling action which occurs will effectively prevent the formation of unmixed pockets of ingredients, whilst the application of relative rotation to the drum and vane structure will ensure efficient and rapid mixture of the ingredients.



An important use for the improved mixer according to the invention is for the admixture of dye powders, in the nominally "dry" state, since it is of the highest importance for dye powders to be thoroughly well mixed. This would normally call for the use of an ordinary drum mixer with its consequent long mixing period, whereas the improved mixer according to this invention has the advantage of the drum type of mixer coupled with the speed of action of the rotary vane type of mixer.

It shall be clearly understood that the invention is in no way limited to the details of the construction of machine described and illustrated, and furthermore that various other constructions of machine embodying individually and/or relative rotatable mixing drum and vaned rotor may be devised, without departing from the scope of the invention.

I claim:

1. A mixing machine including a support having a substantially horizontal bearing; a horizontal drum with a closed end and an axial spindle disposed within the drum and projecting rotatably out through the closed end of said drum and rotatably through the bearing from one side of said bearing; a vaned rotor formed on the spindle within said drum; a hollow shaft connected to the drum and rotatably mounted in said bearing and rotatably supporting said spindle externally of one end of said drum; drive means for driving the hollow shaft; transmission means connected to said spindle, drive means and hollow shaft on the outer ends of the spindle and hollow shaft; and manually operated control means disposed exteriorly of the side of said bearing and exteriorly of said transmission means effective to selectively cause the drive means to rotate the drum and rotor positively in the same or opposite directions.

2. A mixing machine including a support having a substantially horizontal bearing; a horizontal drum with a closed end and an axial spindle disposed within the drum and projecting rotatably out through the closed end of said drum and rotatably through the bearing from one side of said bearing; a vaned rotor formed on the spindle within said drum; a hollow shaft connected to one end of said drum and rotatably mounted in said bearing and rotatably supporting said spindle externally of one end of said drum; drive means for driving the hollow shaft; transmission means connected to said spindle, drive means and hollow shaft on the outer ends of the spindle and hollow shaft; manually operated control means disposed exteriorly of the other side of said bearing and exteriorly of said transmission means effective to selectively cause the drive means to rotate the drum and rotor positively in the same or opposite directions; and means for raising said drum, hollow shaft and spindle about a horizontal axis transversely disposed with respect to the axis of said spindle into a substantially upright position for said drum.

3. A mixing machine comprising a cylindrical drum mounted upon an axial spindle projecting from one end of said drum; a first cylindrical sleeve surrounding the projecting part of said spindle and fixed to the end of said drum, a second cylindrical sleeve surrounding and rotatably supporting the first sleeve; aligned supporting trunnions projecting from said second sleeve at right angles to the spindle axis; a supporting

structure also extending from said second sleeve at right angles to both the trunnion axis and the spindle axis; a driving motor carried by said supporting structure and operative to drive said first sleeve and drum continuously at invariable speed; and controllable transmission means for driving said spindle from said motor at a variable speed and in either direction in relation to the direction of rotation of said drum.

4. A mixing machine comprising a cylindrical drum mounted upon an axial spindle projecting from one end of said drum, a first cylindrical sleeve surrounding the projecting part of said spindle and fixed to the end of said drum; a second sleeve surrounding and rotatably supporting the first sleeve; alined supporting trunnions projecting from said second sleeve at right angles to the spindle axis; a supporting structure also extending from said second sleeve at right angles to both the trunnion axis and the spindle axis; a driving motor carried by said supporting structure, and operative to drive said first sleeve and drum continuously at invariable speed, a driving pulley mounted on said first sleeve; a brake drum mounted on said spindle adjacent to said driving pulley, flanges on the opposed sides of said pulley and brake drum adapted to form therewith a cylindrical chamber; internal teeth disposed within said flanges, a sun pinion on said spindle; axis pins mounted in said chamber on the side of said brake drums; and planet pinions rotatable on the latter axis pins and meshing both with said sun pinion and also with the internal teeth of both of said flanges on the driving pulley and brake drum; and a manually operated brake device operative on said brake drum to control its speed of rotation between a predetermined maximum speed and a stationary condition.

5. A mixing machine comprising a cylindrical drum having an axial spindle extending therethrough and projecting from one end of said drum; an elongated sleeve surrounding the projecting portion of said spindle and fixed to said one end of said drum; bearing means surrounding and rotatably supporting the elongated sleeve; two aligned supporting trunnions projecting externally in opposite directions from said bearing means at right angles to the spindle axis; a supporting structure also projecting rigidly from said bearing means substantially at right angles to both the trunnion axis and said spindle axis; a driving motor mounted on said supporting structure and operative to drive said elongated sleeve and drum continuously at a predetermined speed of rotation; and controllable transmission means for driving said spindle at variable speed independently of the speed of rotation of said drum.

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