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(54) Title: An auger

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An Auger

The present invention is concerned with an auger, and in particular an auger for use with agricultural mixers of the vertical type, which are used for mixing and dispensing feed products such as silage or hay bales, maize, roots, etc.

The augers used in conventional vertical mixers comprise a central core, mounted vertically within the mixer, with a helical flighting wound coaxially around the core. The flighting increases in diameter from the top of the core downwardly to the bottom thereof, thus giving the auger a generally conical shape. The auger is mounted inside a hopper like enclosure into which material is deposited for mixing. The leading edge of the flighting is located adjacent the bottom of the core, in close proximity to the base or floor of the hopper. Thus as the auger rotates, material is scooped past the leading edge onto the flighting, to be forced upwards through the auger by the screw action of the rotating helical flighting. As the material reaches the upper end of the flighting, which is smaller in diameter, the material spills over the trailing edge and the outer or exterior edge of the flighting, thereby dropping back down towards the floor of the hopper, to begin the cycle again, thereby effecting mixing of the material within the hopper. The auger also cooperates with the sidewall of the hopper to cut longer material such as hay into smaller pieces, which further aids in the mixing thereof.

When such mixers are fed with whole bales of hay or the like, it can take considerable time for the bale to be adequately broken down for dispensing from the mixer. The main reason for this is simply the size of the bale, which must be introduced into the hopper through the open top thereof. However, the presence of the auger within the hopper prevents bales from dropping down into the hopper to be acted on by the auger, with the bale thus tending to sit on top of the auger. The auger then rotates ineffectively beneath the bale, only slowly separating material from the bale as a result of the weight of the bale pressing down on the

top of the auger, wherein the trailing edge of the flighting slowly scrapes/tears material off the bale as it rotates therebeneath.

This problem is compounded when bales of lighter material such as straw are to be mixed, as there is less weight pressing down on the top of the auger. This can greatly increase the time taken for bales to be adequately broken up and mixed by the auger. As an alternative, a farmer may manually break up a bale into smaller portions prior to introducing the material into the mixer, which pieces can then migrate downwardly past the auger into the hopper, which will then be more quickly processed by the auger. However, this significantly negates the benefit of such agricultural mixers, which are designed and purchased to reduce the manual labour required of a farmer.

It is therefore an object of the present invention to provide an auger having improved mixing capabilities, in particular when mixing bales of material or the like.

The present invention therefore provides an auger for a vertical mixer, the auger comprising a rotatable core; and a substantially helical flighting mounted about the core, wherein a longitudinal axis of the flighting is offset from an axis of revolution of the core.

Preferably, the diameter of the flighting increases between a first end and a second end of the core.

Preferably, a trailing edge of the flighting is positioned to be positively offset with respect to the axis of revolution of the core such as to increase the effective length of the trailing edge.

Preferably, a leading edge of the flighting is positioned to be positively offset with respect to the axis of revolution of the core such as to increase the effective length of the leading edge.

Preferably, the auger further comprises a plurality of cutters projecting outwardly from an exterior edge of the flighting, at spaced intervals along the exterior edge.

Preferably, the plurality of cutters each have a serrated cutting edge.

Preferably, one of the cutters is located at or adjacent the trailing edge.

Preferably, the auger comprises at least four cutters for each revolution of the flighting.

Preferably, the cutters are mounted on the flighting such as to be disposed, in use, in a substantially horizontal orientation.

Preferably, the cutters are rearwardly swept with respect to the direction of rotation of the auger.

Preferably, the auger comprises at least one feed arm projecting substantially radially outward from the core.

Preferably, the auger comprises three feed arms spaced equally from one another.

Preferably, the or each feed arm has a curved front edge.

Preferably, the flighting extends, in use, substantially horizontally in the radial direction.

As used herein, the term "longitudinal axis" is intended to mean a central axis or an axis which is substantially equidistant from all points on the exterior of an object, when measured in a direction radially outward from the longitudinal axis at any given position along the longitudinal axis.

As used herein, the term "positively offset" is intended to mean being offset away from a point of reference, such that the distance to the point of reference in increased.

The present invention will now be described with reference to the accompanying drawings, in which;

Figure 1 illustrates a perspective view of a preferred embodiment of an auger according to the present invention;

Figure 2 illustrates a plan view of the auger of figure 1; and

Figure 3 illustrates a side elevation of the auger of figure 1.

Referring now to the accompanying drawings, there is illustrated a preferred embodiment of an auger, generally indicated as 10, for mounting in any conventional agricultural mixer (not shown), in particular a vertical mixer (not shown). The auger 10 will normally be used singly within a suitable mixer, but larger capacity mixers (not shown) do exist in which two or more of the augers 10 could be used, arranged side by side, or in any other suitable configuration or array. Vertical mixers normally include a hopper type enclosure within which the auger 10 would be located, the enclosure conventionally having one or more selectively openable doors to facilitate the dispensing of mixed material (not shown) from within the mixer.

The auger 10 comprises a central rotatable core 12, wound around which is a substantially helical flighting 14 which forms the main mixing component of the auger 10. The core 12 is mounted, in use, in operative association with any suitable drive means (not shown), for example a hydraulic motor or the like, such that the auger 10 may be rotated about an axis of rotation of the core 12. Agricultural mixers (not shown) will conventionally have a coupling or drive shaft (not shown) arranged to be coupled to the PTO shaft of a tractor or the like, to provide power for same.

The flighting 14 winds around the core 12 from a first end or bottom 16 of the core 12, to a second end or top 18 of the core 12. Referring to the plan view of figure 2, the auger 10 is rotated, in use, in a clockwise direction. The flighting 14 therefore includes a leading edge 20 adjacent the bottom 16, and a trailing edge 22 adjacent the top 18. The leading edge 20 of the flighting 14 is disposed, in use, in close proximity to a floor (not shown) of the mixer, such that during rotation of the auger 10, material (not show) located within the mixer is driven or scooped up onto the trailing edge 20, and thereafter, by virtue of the rotation of the auger 10, is conveyed upwardly along the flighting 14 towards the trailing edge 22 thereof, in conventional fashion. As the material is conveyed upwardly along the flighting 14, some will fall over the outer edge of the flighting 14, back onto the floor of the mixer, or the portion of flighting 14 located therebeneath. A large portion of the material will however be conveyed to trailing edge 22, and will thereafter spill over the trailing edge 22 back onto a lower portion of the flighting 14, thus repeating the mixing process.

This mixing process is effected for as long as is necessary to mix the material to a desired consistency, during which time the one or more dispensing doors (not shown) of the mixer are kept closed. Once the material has been suitably mixed, one or more of the dispensing doors (not shown) are opened, in order to allow the mixed material to be dispensed therefrom, for example into a feeding trough (not shown) or the like. The mixer may include one or more conveyors (not shown) in

order to draw the mixed material from the hopper of the mixer, again as is conventional.

As highlighted above, bales of material such as hay or silage, in particular bales of light material such as straw, present a problem for conventional augers (not shown), whereby the bales are deposited into the top of the hopper of the mixer, and simply sit atop the conventional auger (not shown), taking considerable time to be broken down into portions which may be processed by the auger as hereinbefore described. The auger 10 of the present invention addresses this problem by eccentrically positioning the flighting 14 relative to the core 12. Thus, in principal, a central longitudinal axis F of the flighting 14 is offset relative to an axis of rotation C of the core 12. This therefore has the result that the trailing edge 22 of the flighting 14, in addition to the portion of the flighting 14 leading to and terminating in the trailing edge 22, has a significantly larger radius than the portion of the flighting 14 diametrically opposed thereto. The increase in the effective length of the trailing edge 22 thus generates greater contact with the bale of material, increasing the scraping/tearing action of the trailing edge 22, and thus hastening the breaking up of the bale.

Furthermore, as the core 12 is rotated, the flighting 14 will also rotate, but eccentrically, and this eccentric motion, in particular of the uppermost portion of the flighting 14, acts to break apart the bale sitting on top of the auger 10. In particular, the motion of the auger 10, in addition to scraping or tearing at the underside of the bale with the trailing edge 22, tends to shake or vibrate the bale as a result of the eccentric rotation of the flighting 14, thus tending to loosen the bale, further increasing the breakdown of same by the auger 10. The combined action of the auger 10 therefore significantly decreases the time taken to break a bale down into portions which can be processed by the auger 10.

In order to aid in the breaking down of bales or the like, the auger 10 also includes a plurality of cutters 24 disposed about the exterior edge of the flighting 14,

extending outwardly therefrom. In the preferred embodiment illustrated four of the cutters 24 are provided per revolution of the flighting 14, or in other words ever 360° travelled around the flighting 14. The cutters 24 preferably include a serrated edge 26 to aid in the chopping of material being processed by the auger 10. The cutters 24, during rotation of the auger 10, chop the material being conveyed up and off the flighting 14, in order to speed-up the mixing of same. The cutters 24 on the lower half of the flighting 14 tend to compress the material against a wall (not shown) of the hopper of the mixer, so improving the ability of the cutters 24 to chop up said material. One cutter 24, as illustrated in the preferred embodiment, is preferably positioned at or adjacent to the trailing edge 22 which, as a result of the eccentric configuration of the flighting 14, results in this uppermost cutter 24 projecting significantly further, radially, than in a conventional auger (not shown). This therefore allows the auger 10 to process larger bales of material, by providing the uppermost cutter 24 with a greater reach.

In order to maximise the effect of the trailing edge 22 and the associated cutter 24 in breaking up a bale of material, the trailing edge 22 must be positioned to be positively offset with respect to the axis of revolution C of the core 12. Due to the eccentric mounted of the flighting 14 on the core 12, half of the flighting 14 will be effectively displaced towards the core 12, while the other half of the flighting 14 will be effectively displaced away from the core 12. Thus the half of the flighting 14 displaced towards the core 12 can be said to be negatively displaced or offset with respect to the core, or more particularly the axis of revolution C thereof, while the other half of the flighting 14 can be said to be positively offset. Thus to maximise the effect of the trailing edge 22, the trailing edge 22 should project, radially, into that portion of the flighting which is positively offset, and preferably to the portion of flighting 14 which has the greatest offset.

The eccentric mounting of the flighting 14 on the core 12 also generates a further improvement in the mixing action of the auger 10. As with the trailing edge 22, the leading edge 20 is also preferably positioned on the positively offset side of

the flighting 14, again to increase the effective length of the leading edge 20. As a result of the increased length of the leading edge 20, a greater volume of material will be scooped onto the fligting 14 by the leading edge 20, increasing the mixing action of the auger 10. It will therefore be appreciated that, as with the trailing edge 22, it is preferable that the leading edge 20 should project, radially, into that portion of the flighting 14 which has the greatest positive offset.

To further increase the efficacy of the auger 10, the core 12 is reduced in diameter in comparison to conventional augers (not shown). This reduction in the diameter of the core 12 has the effect of allowing a larger quantity of material to be retained within the mixer, thus improving the capacity of same. In addition, the narrower core 12 also allows more material to be retained in the lower half of the auger 10, where, as described above, the respective cutters 24 are more effective by virtue of compressing the material against the wall of the mixer.

The auger 10 also includes a plurality, preferably three or more, feed arms 28 extending substantially radially outward from the core 12, at or adjacent the bottom 16 thereof. These feed arms 28 pre-compress material in order to provide an improved chopping effect by the cutters 24 in the lower half of the auger 10. In addition, when the mixed material is to be dispensed, the plurality of feed arms 28 generate a more consistent feed of material to the doors (not shown) of the mixer. In this regard, each feed arm 28 preferably includes a curved front edge 30 which acts to force material towards the wall of the mixer, again improving the amount of contact the material has with the cutters 24, in addition to improving the rate of feed of material to the doors of the mixer, when the mixed material is to be dispensed therefrom.

The auger 10 of the present invention therefore provides a simple yet effective means of improving the mixing action of agricultural vertical mixers, or any other mixer utilising the auger 10, by eccentrically mounting the flighting 14 on the core 12, giving rise to a number of performance improvements which together can

significantly improve the mixing action of the auger 10, in particular when processing whole bales of materia..

The present invention is not limited to the embodiments described herein, which may be amended or modified without departing from the scope of the present invention.

Claims

1. An auger for a vertical mixer, the auger comprising a rotatable core; and a substantially helical flighting mounted about the core, wherein a longitudinal axis of the flighting is offset from an axis of revolution of the core.

2. An auger according to claim 1 in which the diameter of the flighting increases between a first end and a second end of the core.

3. An auger according to claim 1 or 2 in which a trailing edge of the flighting is positioned to be positively offset with respect to the axis of revolution of the core such as to increase the effective length of the trailing edge.

4. An auger according to any of claims 1 to 3 in which a leading edge of the flighting is positioned to be positively offset with respect to the axis of revolution of the core such as to increase the effective length of the leading edge.

5. An auger according to claim 3 or 4 further comprising a plurality of cutters projecting outwardly from an exterior edge of the flighting, at spaced intervals along the exterior edge, one of the cutters being located at or adjacent the trailing edge.

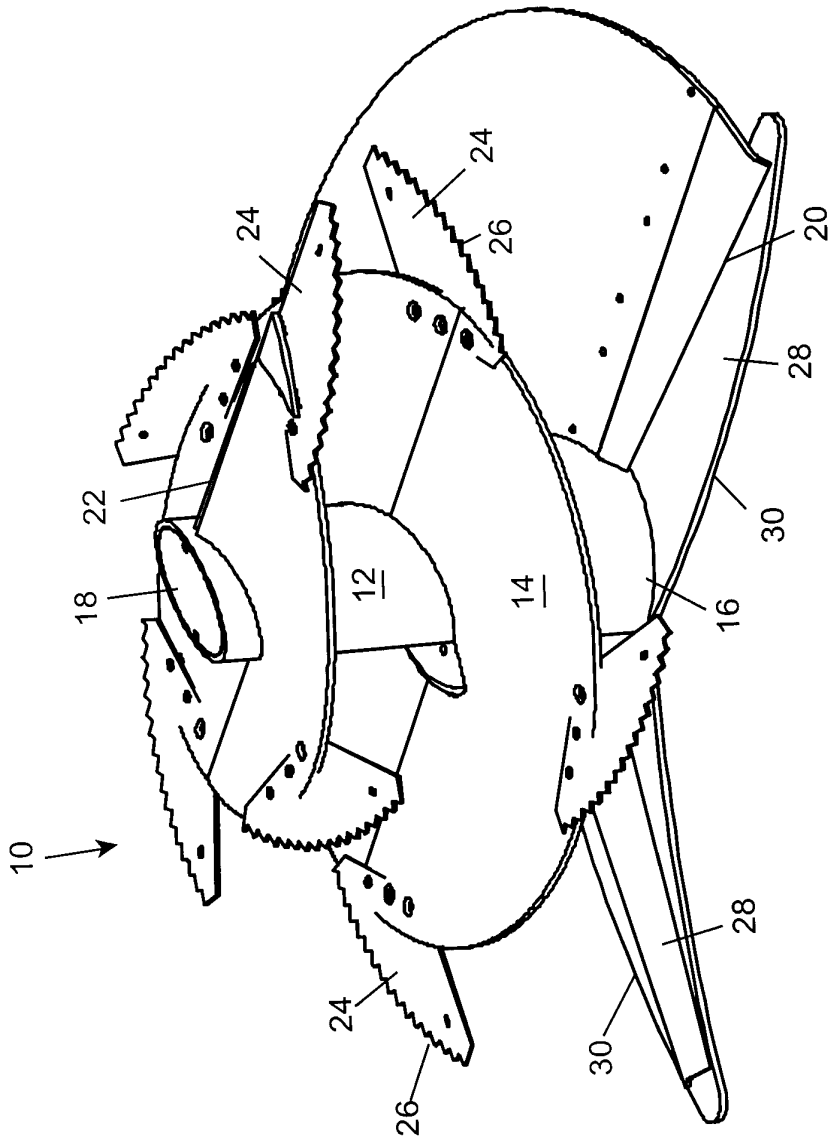

Fig. 1

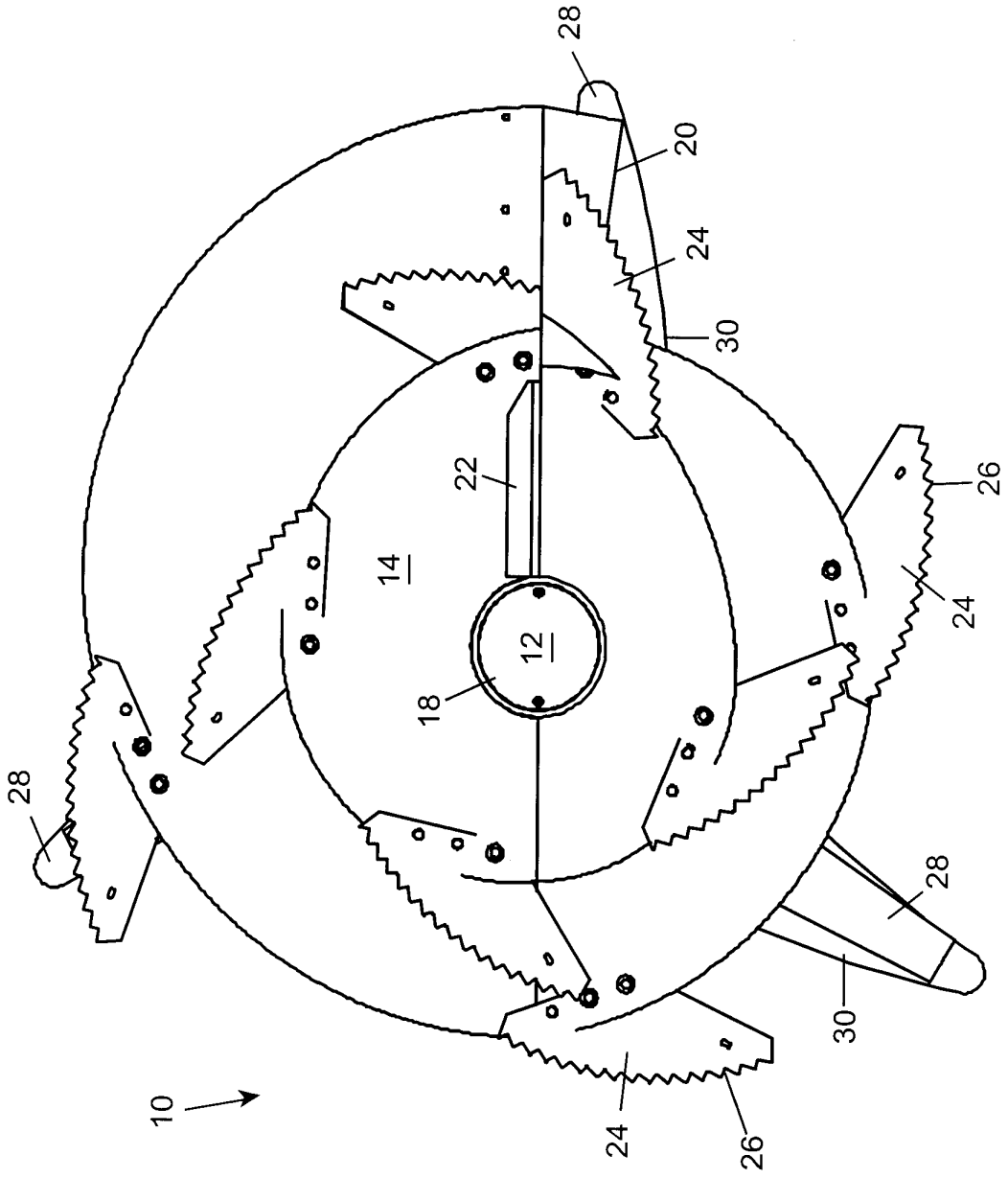

Fig. 2

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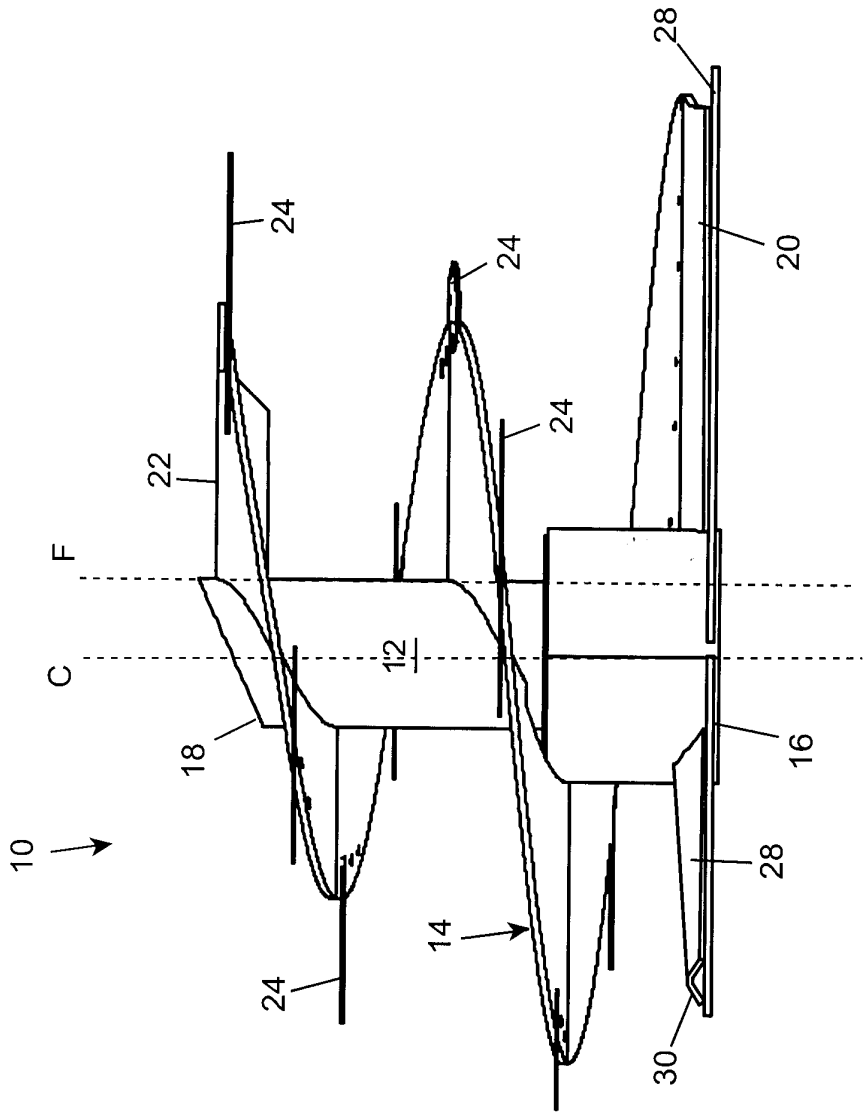

Fig. 3