PATENT SPECIFICATION

Application Date: Jan. 25, 1944. No. 1373/44. **574,344**

" " Feb. 26, 1945. No. 4762/45.

One Complete Specification left (under Section 16 of the Patents and Designs Acts, 1907 to 1942): Feb. 26, 1945.

Specification Accepted: Jan. 1, 1946.

PROVISIONAL SPECIFICATION

No. 1373 A.D. 1944.

Concrete Aerating Machine

We, NORMAN ROBERT NEAL, a British subject, of Plant House, Longfield Avenue, Ealing, London, W.5, and CHEECOL LIMITED, a British Company, of 11, Waterloo Place, Westminster, London, S.W.1, do hereby declare the nature of this invention to be as follows:—

It is already known to manufacture lightweight concrete by including air in a concrete slurry mix of cement, sand and water so as to aerate the mixture and thereby cause its volume to be considerably increased. The aerated mix may be stabilised by the addition of a wetting agent to the mix as described in prior Patent No. 546,335. A particularly suitable wetting agent is that known under the Registered Trade Mark " Cheecol " which is added in small quantity to the mixing water.

The present invention provides a machine for effecting such aeration while mixing the slurry ingredients. According to the present invention there is provided a whisk for a concrete aerating machine comprising an open rotatable structure having members constructed and arranged, during rotation, to propel the mix from the inside of the structure to create a region of reduced pressure therein and a tube or tubes for leading air to said region of reduced pressure. The whisk, in use, is caused to dip into the mix in a container and may be mounted so as to be movable vertically so that it may be raised and lowered at the beginning and end of the mixing operation, or if required during mixing; if desired, the whisk may remain stationary and the container itself raised or lowered. Generally, the container will form no part of the machine, it being intended that a skip or other container as commonly used in concrete working shall be used with the new machine. However, the inclusion of a container as part of the machine is not excluded.

The machine may have a suitable upstanding framework or other form of standard which supports the machine parts. The whisk may be rotatably carried by a suitable frame or other form of carrier which is mounted so as to be slidable up and down the standard on or in slides or guides fixed to or otherwise provided on the standard. The whisk may be mounted on the lower portion of an axle or shaft which extends upwardly and is there supported in bearings provided on the whisk carrier, so that the whisk is disposed below and clear of its carrier. For raising and lowering the whisk and carrier assembly, any suitable mechanism may be provided, but preferably for this purpose the assembly is balanced by a counterweight and connecting rope passing over one or more pulleys mounted on the standard, and is raised and lowered manually by means of a suitable handle. The whisk may be rotated by a motor, e.g. an electric motor or petrol engine, which may drive the whisk shaft through a suitable transmission, such as a chain or belt drive to a countershaft and thence by bevel gearing to the whisk shaft. The whisk driving mechanism is preferably mounted on the whisk carrier, so as to be unaffected by, and not to interfere with, the raising and lowering of the carrier.

For admitting air to the mix, the shaft of the whisk may be made tubular so that air can pass down it and be perforated with holes, located within the whisk in the region of reduced pressure, through which the air can pass into the mix; alternatively a tube or tubes may be secured to the shaft and may terminate in nozzles suitably located or may be perforated as above referred to.

According to a feature of the invention, the whisk comprises a cylindrical or frusto-conical cage-like structure of blades, arranged around the periphery and, if desired, the bottom thereof so that, as the cage is revolved in the mix, the blades act to drive the mix out of the cage whereby the region of reduced pressure is created inside the cage, enabling the ready inflow of air through the holes in

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the hollow shaft of the whisk, or through the air tubes, referred to above. The cage structure may, if desired, comprise blades arranged not only around the periphery and bottom thereof and set so as to drive the mix outwards from the cage, but also blades arranged at the top of the structure and set so as to drive the mix inwards into the cage. At the bottom, the cage may also have additional blades extending laterally outwards which are set so as to drive the mix upwards outside the cage. These additional blades may consist of extensions of the above mentioned bottom blades, but set in opposition thereto, as will be appreciated from the foregoing.

In a preferred form, given by way of illustration and for a clearer understanding of the cage structure, the cage has the general appearance of a right circular conical frustum with the larger diameter uppermost and surmounted by a right circular cone based on that diameter the shaft aforesaid extending vertically and axially through the structure and upwards from the cone apex. The frustum constitutes the main part of the structure and its height may be made about equal to or slightly less than its smaller (i.e. bottom) diameter, and its larger and smaller diameters may be in the ratio of about 4 to 3. The frustum portion may be higher than the cone portion, for instance in the ratio of about 4 to 3.

The frustum portion is bounded top and bottom by spider plates each comprising arms radiating from a hub through which the shaft passes, a ring being welded or otherwise secured to the arms, after the fashion of a wheel. The upper plate may for convenience be called the centre plate of the structure as upon it is disposed the cone portion. The slant sides of the frustum portion are formed by an outer set of straight-bar blades secured (as by welding) at their ends to the bottom and centre plates at circumferentially spaced intervals therearound. The bottom plate may have twelve arms at 30° spacings, the centre plate may have six arms at 60° spacings, and the outer set of blades may comprise twelve blades at 30° spacings registering with the spacings of the bottom plate arms, the lower ends of the blades being secured to those arms respectively, while the upper ends of the blades are secured to the ring of the centre plate. The arms of the centre plate are not disposed so as to be in vertical registry with alternate arms of the bottom plate, but are offset with respect thereto, conveniently by 15°, and an inner set of six straight bar blades arranged in a cone with apex downwards are secured at their upper ends to the outer ends of the arms of the centre plate, the lower ends of the blades being secured to the hub of the bottom plate at 60° spacings therearound. Thus, the frustum portion of the cage has an outer peripheral set of blades and an inner conical set, the two sets being angularly offset with respect to each other. It will be appreciated that the blades of the outer set are inclined at a smaller angle to the axis of the shaft than are the blades of the inner set. The blades of the outer and inner sets are each turned through an angle of for instance 12° in the same direction so as to be oblique to the vertical shaft, and to drive outwards.

The previously mentioned air holes in the hollow shaft are provided in the portion thereof between the centre and bottom plates.

The arms of the bottom plate are formed as blades by being turned or twisted out of the planes of the plate, for instance through 12°, in a direction so that they drive outwards, that is to say, downwards from the bottom of the cage. These arms are also preferably formed with extensions projecting radially outwards from the plate ring which are formed in like manner as blades turned for instance through 12°, but are turned in opposition to the other blades so as to drive upwards outside the cage.

The upper cone portion of the cage comprises a set of straight bar blades equiangularly spaced and secured at their lower ends to the ring of the centre plate and at their upper ends to a collar on the shaft. The blades of this upper set, which may be eight in number at 45° spacings, are each turned through for instance 12° in the same direction so as to be oblique to the shaft, and to drive inwards, that is into the cage.

The blades of the outer, inner and upper sets may if desired be rounded along one edge and tapered to ogival shape in section along the opposite edge although such shaping of the blades is not necessary and they are conveniently formed of rectangular section bar metal. With a construction of cage as described, as the cage is revolved, the mix is not only forced to rotate about a vertical axis within the cage but is also subjected to radially and downwardly directed forces urging it out of the cage and at the same time being caused to circulate about a horizontal axis by the action of the exterior portions of the bottom blades and the in-drawing action of the top set of blades. As a result of these various forces the mix is caused to undergo a spiral, or worm-like, motion within the cage. Moreover, there is a greater tendency to drive out the mix from the cage than there is for the mix to

return to the cage through the top portion. Consequently, a condition of reduced pressure is created inside the cage, and since the inertia of the mix is greater than that of air, it is easier for air to flow into the cage through the hollow main shaft or through the separate tubes provided for this purpose, than for the mix to return to the cage through the upper portion of the cage, thus ensuring a steady flow of air into the mix so that the whole mix eventually becomes aerated.

Although in order to assist the description various specific details have been mentioned herein, it is to be understood that these are given by way of illustration and example only and that modifications may be made and other constructional forms devised without departing from the invention.

Dated the 25th day of January, 1944.

KINGS PATENT AGENCY LIMITED.
By R. HUNTER,
Secretary,
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Agents for the Applicants.

PROVISIONAL SPECIFICATION

No. 4762 A.D. 1945.

Concrete Aerating Machine

We, NORMAN ROBERT NEAL, a British subject, of Plant House, Longfield Avenue, Ealing, London, W.5, and CHEECOL (HOLDINGS) LIMITED, a British Company, of 11, Waterloo Place, Westminster, London, S.W.1, do hereby declare the nature of this invention to be as follows:—

It is already known to manufacture lightweight concrete by including air in a concrete slurry mix of cement, sand and water so as to aerate the mixture and thereby cause its volume to be considerably increased. The aerated mix may be stabilised by the addition of a wetting agent to the mix as described in prior Patent No. 546,335. A particularly suitable wetting agent is that known under the Registered Trade Mark "Cheecol" which is added in small quantity to the mixing water.

The present invention provides a machine for effecting such aeration while mixing the slurry ingredients. According to the present invention there is provided a whisk for a concrete aerating machine comprising a rotary cage-like structure of blades which is adapted for rotation about an upright axis in the mix so as to produce a vortex motion of the mix within the cage; the structure comprising main blades disposed around the cage periphery and arranged to develop outward thrust acting to expel the mix from the cage periphery, and blades at the bottom of the cage disposed to develop downward thrust acting to expel the mix from the cage bottom. Preferably there are also provided blades at the top of the cage disposed to impel the mix into the cage. At the bottom, the cage has additional blades extending laterally outwards which are set so as to drive the mix upwards outside the cage. These additional blades may comprise extensions of the above mentioned bottom blades, but set in opposition thereto, as will be appreciated from the foregoing.

The whisk is mounted on a shaft by which it is rotatably supported by a suitable carrier, and the whisk may be power-driven by a motor, e.g., an electric motor or petrol engine, which may drive the whisk shaft through a suitable transmission.

The whisk, in use, is caused to dip into the mix in a suitable container which may form part of the aerating machine and may be provided with a suitable valved or covered discharge outlet in its bottom. The whisk and container may be adapted to be raised and lowered relatively to each other, or not, as desired.

In the operation of the whisk, a region of reduced pressure is set up therein and air is drawn into the vortex about the axis of rotation so as to be incorporated in and aerate the mix. If desired, a tube or tubes may be provided for leading air to the reduced pressure zone of the whisk. For instance, the shaft of the whisk may be made tubular and perforated with holes through which air can pass into the mix, or a tube or tubes may be secured to the shaft and may be perforated or terminate in nozzles suitably located.

The whisk comprises a cage structure having the general appearance of a right circular conical frustum with the larger diameter lowermost, which is mounted on a shaft extending vertically and axially through the structure. The cage is bounded top and bottom by spiders which are of similar construction but of different diameters, each comprising arms radiating

from a hub through which the shaft passes, a ring being welded or otherwise secured to the arm. The slant sides of the cage are formed by a set of straight-bar main blades secured (as by welding) at their ends to the top and bottom rings at circumferentially spaced intervals therearound. The spiders each have five arms equally and correspondingly spaced around the rings at 72° spacings, the set of main blades comprising ten blades at 36° spacings, alternate blades registering with the arms. The main blades are each turned through an angle of for instance 12° in the same direction so as to be oblique to the vertical shaft, and to drive outwards. The arms are formed into blades by being similarly turned or twisted out of the planes of the respective spiders, for instance through 12°, in a direction so that they drive downwards. Thus, the top blades drive into the top of the cage and the bottom blades drive out of the bottom of the cage. Secured to the bottom ring, as by welding, are further blades projecting radially outwards from the ring, the blades being turned for instance through 12°, but in opposition to the bottom blades so as to drive upwards outside the cage. The outwardly projecting blades are the same in number and disposition with respect to the bottom ring, as the main blades.

Before starting the whisk the level of the mix is well below the top of the whisk cage. As the whisk is revolved at a suitable speed the mix is not only forced to rotate about a vertical axis within the cage, but is also subjected to radially and downwardly directed thrusts by the main blades and bottom blades, urging it out of the cage, and at the same time is caused to circulate about a horizintal axis by the upward thrust of the outwardly projecting blades and the impelling thrust of the top blades. As a result of these various forces the mix is caused to undergo a spiral motion within the cage, travelling downwards and outwards as it spins. A vortex is produced at the axis of the whisk, drawing a steady flow of air into the mix to aerate it as it travels through the cage, the resultant increase in volume of the mix causing it to rise outside the cage, assisted by the upthrust of the outwardly projecting blades, and eventually to cascade over into the top of the whisk. Thus, a circulation of the mix down through the interior of the whisk and up on the outside thereof is set up, and the mix absorbs repeated quantities of air as it circulates through the whisk, to produce a highly aerated mix in an efficient manner.

The described embodiment is given by way of illustration and example only, since modifications may be made therein and other constructional forms devised without departing from the invention.

In order to ensure of the machine operating in the manner above described it is necessary for the whisk cage to rotate at a sufficiently high speed, and by way of example, if the overall diameter over the external blades measure 1′ 9″ then the speed preferably is not less than about 300 revolutions per minute.

Dated the 26th day of February, 1945.

KINGS PATENT AGENCY LIMITED.
By R. HUNTER,
Secretary,
Registered Patent Agents,
146A, Queen Victoria Street,
London, E.C.4,
Agents for the Applicants.

COMPLETE SPECIFICATION

Concrete Aerating Machine

We, NORMAN ROBERT NEAL, a British subject, of Plant House, Longfield Avenue, Ealing, London, W.5, and CHEECOL (HOLDINGS) LIMITED (formerly known as Cheecol Limited), a British Company, of 11, Waterloo Place, Westminster, London, S.W.1, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

It is already known to manufacture lightweight concrete by including air in a concrete slurry mix of cement, sand and water so as to aerate the mixture and thereby cause its volume to be considerably increased. The aerated mix may be stabilised by the addition of a wetting agent to the mix as described in prior Patent No. 546,335. A particularly suitable wetting agent is that known under the Registered Trade Mark "Cheecol" which is added in small quantity to the mixing water.

The present invention provides a machine for effecting such aeration while mixing the slurry ingredients. According to the present invention there is provided a whisk for a concrete aerating machine comprising a rotary cage-like structure of blades which is adapted for rotation about

an upright axis in the mix so as to produce a vortex motion of the mix within the cage; the structure comprising main blades disposed around the cage periphery and arranged to develop outward thrust acting to expel the mix from the cage periphery, and blades at the bottom of the cage disposed to develop downward thrust acting to expel the mix from the cage bottom. Preferably, there are also provided blades at the top of the cage disposed to impel the mix into the cage. At the bottom, the cage has additional blades extending laterally outwards which are set so as to drive the mix upwards outside the cage. These additional blades may comprise extensions of the above mentioned bottom blades, but set in opposition thereto, as will be appreciated from the foregoing.

The whisk is mounted on a shaft by which it is rotatably supported by a suitable carrier, and the whisk may be power-driven by a motor, e.g., an electric motor or petrol engine, which may drive the whisk shaft through a suitable transmission.

The whisk, in use, is caused to dip into the mix in a suitable container which may form part of the aerating machine and may be provided with a suitable valved or covered discharge outlet in its bottom. The whisk and container may be adapted to be raised and lowered relatively to each other, or not, as desired.

In the operation of the whisk, a region of reduced pressure is set up therein and air is drawn into the vortex about the axis of rotation so as to be incorporated in and aerate the mix. If desired, a tube or tubes may be provided for leading air to the reduced pressure zone of the whisk. For instance, the shaft of the whisk may be made tubular and perforated with holes through which air can pass into the mix, or a tube or tubes may be secured to the shaft and may be perforated or terminate in nozzles suitably located.

In order that the invention may be more fully understood, a preferred embodiment of the whisk is illustrated in the accompanying drawings, in which,

Figure 1 is a view of the whisk, being a section on line 1—1 of Figure 2;

Figure 2 is a section on line 2—2 of Figure 1, showing a plan of the whisk bottom;

Figure 3 is a plan of the whisk top; and

Figure 4 is a diagram illustrating the operation of the whisk.

Referring to Figures 1 to 3, the whisk comprises a cage structure having the general appearance of a right circular conical frustum with the larger diameter lowermost, which is mounted on a shaft 1 extending vertically and axially through the structure. The cage is bounded top and bottom by spiders generally denoted 2 and 3 which are of similar construction but of different diameters, each comprising arms 4 radiating from a hub 5 through which the shaft 1 passes, a ring 6 being welded or otherwise secured to the arm 4. The slant sides of the cage are formed by a set of straight-bar main blades 7 secured (as by welding) at their ends to the top and bottom rings 6 at circumferentially spaced intervals therearound. The spiders 2 and 3 are shown as each having five arms 4 equally and correspondingly spaced around the rings 6 and 72° spacings, the set of main blades 7 comprising ten blades at 36° spacings, alternate blades 7 registering with the arms 4, as seen in Figures 2 and 3. The main blades 7 are each turned through an angle of for instance 12° in the same direction so as to be oblique to the vertical shaft 1, and to drive outwards. The arms 4 are formed into blades by being similarly turned or twisted out of the planes of the respective spiders 2 and 3, for instance through 12°, in a direction so that they drive downwards. Thus, the top blades 4 drive into the top of the cage and the bottom blades 4 drive out of the bottom of the cage. Secured to the bottom ring 6, as by welding, are further blades 8 projecting radially outwards from the ring, the blades 8 being turned for instance through 12°, but in opposition to the bottom blades 4 so as to drive upwards outside the cage. The blades 8 are shown as being the same in number and disposition with respect to the bottom ring 6, as the main blades 7.

The operation of the whisk as described is diagrammatically illustrated in Figure 4, in which the whisk cage represented in outline 9 is depicted in working position in a container 10 containing the mix to be aerated, the level of which, before starting the whisk, is well below the top of the whisk cage, for instance as indicated at 11. As the whisk is revolved at a suitable speed the mix is not only forced to rotate about a vertical axis within the cage, but is also subjected to radially and downwardly directed thrusts by the main blades 7 and bottom blades 4, urging it out of the cage, and at the same time is caused to circulate about a horizontal axis by the upward thrust of the blades 8 and the impelling thrust of the top blades 4. As a result of these various forces the mix is caused to undergo a spiral motion within the cage, travelling downwards and outwards as it spins. A vortex as indicated at 12 is produced at the axis of the whisk, drawing a steady flow of air into the mix to aerate it as it travels through the cage, the resultant increase in volume of the mix

causing it to rise outside the cage, assisted by the upthrust of the blades 8, and eventually to cascade over into the top of the whisk. Thus, a circulation of the mix down through the interior of the whisk and up on the outside thereof is set up, as represented by the arrows in Figure 4, and the mix absorbs repeated quantities of air as it circulates through the whisk, to produce a highly aerated mix in an efficient manner.

The described embodiment is given by way of illustration and example only, since modifications may be made therein and other constructional forms devised without departing from the invention.

In order to ensure of the machine operating in the manner above described it is necessary for the whisk cage to rotate at a sufficiently high speed, and by way of example, if the overall diameter over the external blades 8 measures 1′ 9″ then the speed preferably is not less than about 300 revolutions per minute.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A whisk for a concrete aerating machine, comprising a rotary cage-like structure of blades which is adapted for rotation about an upright axis in a mix to be aerated so as to produce a vortex motion of the mix within the whisk, the cage structure comprising main blades disposed around the cage periphery and arranged to develop outward thrust acting to expel the mix from the cage periphery, blades at the bottom of the cage disposed to develop downward thrust acting to expel the mix from the cage bottom, and blades projecting laterally outwards and inclined to produce upward thrust on the mix outside the cage.

2. A whisk for a concrete aerating machine, comprising a rotary cage-like structure of blades which is adapted for rotation about an upright axis in a mix to be aerated so as to produce a vortex motion of the mix within the whisk, the cage structure having a substantially frusto-conical form and comprising a set of main blades constituting the slant sides of the cage and inclined obliquely to the axis thereof so as to develop a radially outwardly directed thrust on the mix as the cage revolves, a set of blades extending across the bottom of the cage and inclined to develop a downward thrust, and blades projecting laterally outwards and inclined to produce upward thrust on the mix outside the cage.

3. A whisk for a concrete aerating machine according to Claim 1 or 2, having a top set of blades disposed to impel the mix into the cage.

4. A whisk as claimed in Claim 1 or 2, wherein the blades projecting from the periphery of the cage are situated at the bottom of the cage.

5. A whisk as claimed in Claim 1, 2, 3 or 4, wherein the blades constituting the cage structure are symmetrically arranged with respect to the axis of rotation of the cage.

6. A whisk as claimed in any preceding claim, wherein the cage structure is mounted symmetrically on an upright shaft having driving means associated therewith for rotating the cage.

7. A whisk as claimed in any preceding claim, having a tube or tubes arranged for leading air to the centre of the cage.

8. A whisk as claimed in Claim 7, wherein the cage is mounted on a hollow shaft which extends into the cage and is adapted for delivering air therethrough into the cage.

9. A concrete aerating whisk constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings.

10. A concrete aerating machine comprising a container for the mix to be aerated, a whisk as claimed in any preceding claim located or adapted to be introduced within said container, and a power-operated driving mechanism for rotating said whisk.

Dated the 26th day of February, 1945.
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Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1946. Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies, price 1s. 0d. each (inland) 1s. 1d. (abroad) may be obtained.

causing it to rise outside the cage, assisted by the upthrust of the blades 8, and eventually to cascade over into the top of the whisk. Thus, a circulation of the mix down through the interior of the whisk and up on the outside thereof is set up, as represented by the arrows in Figure 4, and the mix absorbs repeated quantities of air as it circulates through the whisk, to produce a highly aerated mix in an efficient manner.

The described embodiment is given by way of illustration and example only, since modifications may be made therein and other constructional forms devised without departing from the invention.

In order to ensure of the machine operating in the manner above described it is necessary for the whisk cage to rotate at a sufficiently high speed, and by way of example, if the overall diameter over the external blades 8 measures 1′ 9″ then the speed preferably is not less than about 300 revolutions per minute.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A whisk for a concrete aerating machine, comprising a rotary cage-like structure of blades which is adapted for rotation about an upright axis in a mix to be aerated so as to produce a vortex motion of the mix within the whisk, the cage structure comprising main blades disposed around the cage periphery and arranged to develop outward thrust acting to expel the mix from the cage periphery, blades at the bottom of the cage disposed to develop downward thrust acting to expel the mix from the cage bottom, and blades projecting laterally outwards and inclined to produce upward thrust on the mix outside the cage.

2. A whisk for a concrete aerating machine, comprising a rotary cage-like structure of blades which is adapted for rotation about an upright axis in a mix to be aerated so as to produce a vortex motion of the mix within the whisk, the cage structure having a substantially frusto-conical form and comprising a set of main blades constituting the slant sides of the cage and inclined obliquely to the axis thereof so as to develop a radially outwardly directed thrust on the mix as the cage revolves, a set of blades extending across the bottom of the cage and inclined to develop a downward thrust, and blades projecting laterally outwards and inclined to produce upward thrust on the mix outside the cage.

3. A whisk for a concrete aerating machine according to Claim 1 or 2, having a top set of blades disposed to impel the mix into the cage.

4. A whisk as claimed in Claim 1 or 2, wherein the blades projecting from the periphery of the cage are situated at the bottom of the cage.

5. A whisk as claimed in Claim 1, 2, 3 or 4, wherein the blades constituting the cage structure are symmetrically arranged with respect to the axis of rotation of the cage.

6. A whisk as claimed in any preceding claim, wherein the cage structure is mounted symmetrically on an upright shaft having driving means associated therewith for rotating the cage.

7. A whisk as claimed in any preceding claim, having a tube or tubes arranged for leading air to the centre of the cage.

8. A whisk as claimed in Claim 7, wherein the cage is mounted on a hollow shaft which extends into the cage and is adapted for delivering air therethrough into the cage.

9. A concrete aerating whisk constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings.

10. A concrete aerating machine comprising a container for the mix to be aerated, a whisk as claimed in any preceding claim located or adapted to be introduced within said container, and a power-operated driving mechanism for rotating said whisk.

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