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BOWL CONSTRUCTION FOR ROTARY FINISHING MACHINE

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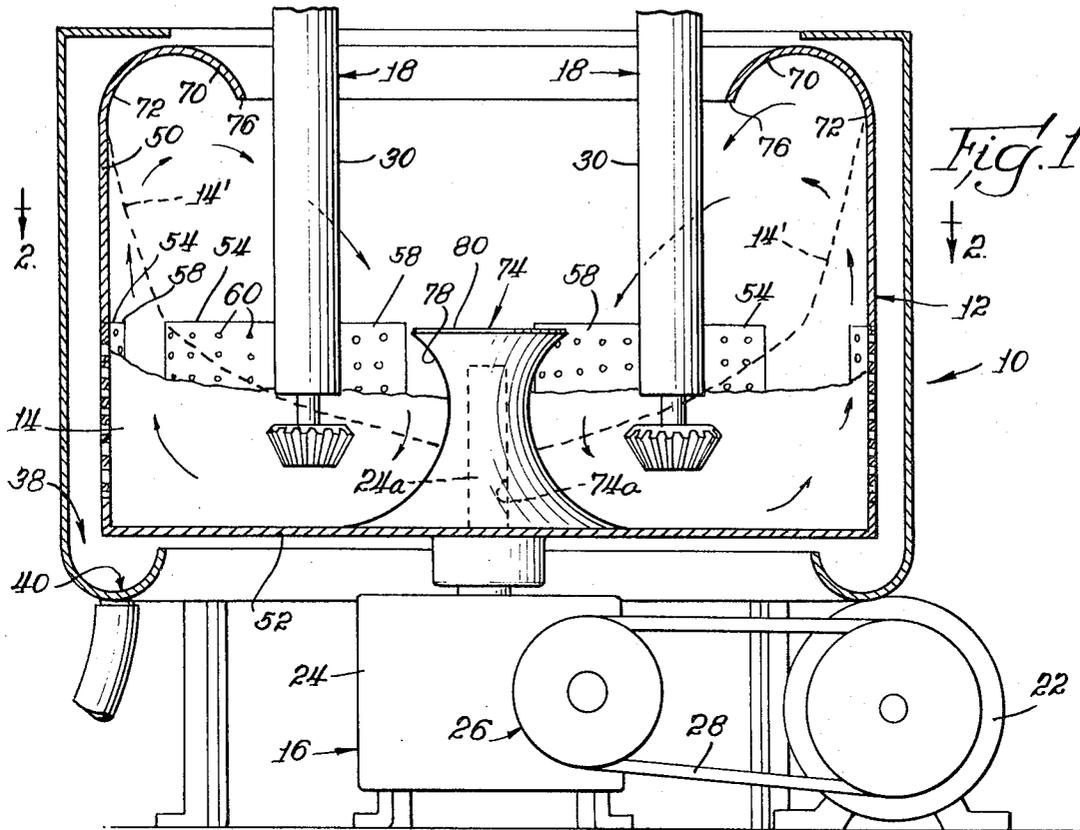


Fig. 1.

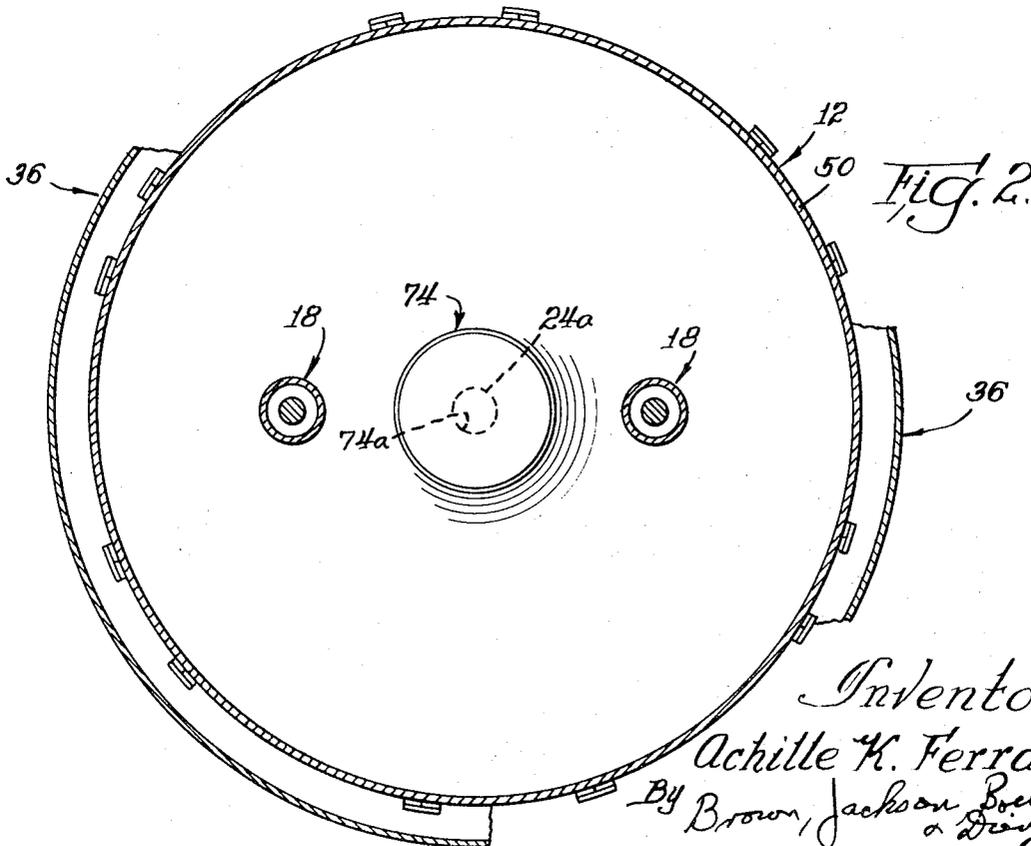


Fig. 2.

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BOWL CONSTRUCTION FOR ROTARY FINISHING MACHINE

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11 Claims

ABSTRACT OF THE DISCLOSURE

In a bowl for a rotary finishing machine, a radially inwardly extended peripheral flange is provided at the upper periphery, and an upright hub is integral with the bottom wall of the bowl and coaxial with the bowl.

BACKGROUND OF THE INVENTION

This invention relates to improvements in a rotary finishing machine of the type comprising a rotatable bowl adapted to contain a mass of abrasive finishing media, means for rotating the bowl, and means for turning workpieces in the path of the mass of abrasive finishing media.

Machines of this type have wide industrial application for deburring, cleaning, polishing, and the like. Abrasive finishing media used in these diverse operations is uniformly classified by size and type and may range from fine grits for use in polishing to heavy chips for use in heavy deburring. Abrasive finishing media may be formed of limestone or other natural materials or may be formed of a manufactured ceramic-based or plastic-based material. Abrasive finishing media formed of any of these materials fragment in use, producing abrasive fines.

The bowl of a conventional machine of this type has a generally cylindrical wall and a generally circular bottom wall integral at its outer periphery with the lower periphery of the generally cylindrical wall. In at least a lower portion of the generally cylindrical wall, perforations are provided for screening the mass of abrasive finishing media so as to permit radially outward discharge of abrasive fines and other waste material and retain the remainder of the charge or mass of abrasive finishing media within the bowl. Washing liquid, such as a solution of detergent in water, may be introduced into the bowl during rotation of the bowl through a spray head or the like. Such washing liquid helps to remove abrasive fines and other waste materials and is discharged through the perforations in the generally cylindrical wall of the bowl. Usually, the discharged matter is confined by an outer stationary protective housing and falls into a trough beneath from which it is carried to a drain. Such a housing also serves to protect the machine operator from injury caused by rotation of the bowl or discharge of matter from the bowl.

In a conventional machine of this type, the workpieces are held in suitable chunks or collets and are turned in the path of the mass of abrasive finishing media by suitably arranged rotatable spindles. Usually, from one to three workpieces are finished at one time in regularly spaced relationship in a generally annular useful work zone within the bowl. During rotation of the bowl, the media particles which strike the workpieces are violently disturbed and, depending on the shapes of the workpieces, may be broadcast in plural directions throughout the bowl.

Centrifugal action tends to cause the mass of abrasive finishing media to become concentrated against the generally cylindrical wall of the bowl. The media particles tend to migrate generally radially outwardly from the center of the bowl and generally upwardly along the generally cylindrical wall of the bowl. It has been observed

that, the faster the bowl is rotated, the higher the abrasive finishing media tend to build up along the generally cylindrical wall of the bowl. In gross, the mass of abrasive finishing media behaves like liquid in a spin-dryer.

In order to eliminate loss of media particles from the open top of the bowl of such a machine, it is necessary, either to limit the speed of rotation of the bowl to a sufficiently low speed that media particles which strike the workpieces are not broadcast beyond the upper periphery of the generally cylindrical wall and likewise that the mass of abrasive finishing media does not tend to build up against the generally cylindrical wall to a greater extent than can be confined by said wall, or to construct the bowl in such a manner as to effectively confine the media particles at the desired speeds of rotation of the bowl.

Limitation of the speed of rotation of the bowl is not favored. As a result of limiting the speed of rotation of the bowl, the energy imparted to media particles by the rotating bowl and the overall capabilities of the machine are limited accordingly.

This invention is addressed to the problem of providing a rotary finishing machine having a bowl which is constructed in such a manner as to effectively confine the media particles at any desired speed of rotation of the bowl.

SUMMARY OF THE INVENTION

It is one object of this invention to provide a rotary finishing machine having a bowl which is constructed in such a manner as to effectively confine the media particles at any desired speed of rotation of the bowl.

It is another object of this invention to provide a rotary finishing machine having a bowl which is constructed in such a manner as to comprise means for recirculating the mass of abrasive finishing media around the workpieces during rotation of the bowl.

In accordance with the principles of this invention, the foregoing objects may be attained in a rotary finishing machine, of the aforementioned type, having a bowl which comprises a radially inwardly extending peripheral flange, integral with the upper periphery of the generally cylindrical wall of the bowl, and an enlarged upright hub, integral with the bottom wall of the bowl and coaxial with the bowl. The flange should be concave-curvilinear relative to the bowl, thereby being adapted to recirculate abrasive finishing media which move generally upwardly along the generally cylindrical wall past the upper periphery of the generally cylindrical wall of the bowl during rotation of the bowl. The hub should have a concave-curvilinear side wall adapted to recirculate abrasive finishing media driven toward the hub upon impact with the workpieces during rotation of the bowl.

These and other objects, features, and advantages of this invention will be evident from the following description, with the aid of the attached drawings, of a preferred embodiment of this invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is an elevational view, partly in section, of a rotary finishing machine embodying the principles of this invention; and

FIG. 2 is a sectional view, partly fragmented, taken substantially along section line 2—2 of FIG. 1 in the direction of the arrows.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, there is illustrated a rotary finishing machine, indicated generally at 10, constituting the presently preferred embodiment of this invention. The rotary finishing

machine 10 generally comprises a rotatable bowl 12 adapted to contain a charge or mass of abrasive finishing media 14, means 16 for rotating the bowl 12, and means 18 for turning workpieces in the path of the mass of abrasive finishing media 14.

The means 16 for rotating the bowl 12 comprises a conventional electric motor 22 and a conventional right-angle speed reducer 24, preferably interconnected by means of a conventional split-sheave variable-speed pulley system, indicated generally at 26, employing a V-belt 28.

The means 18 for turning workpieces in the path of the mass of abrasive finishing media 14 is conventional in rotary finishing machines. As shown, the means 18 comprises a pair of generally cylindrical housings 30 each supporting a suitable chuck or collet (not shown), by means of which a variety of workpieces may be held. In the drawings, bevel gears are shown as exemplary workpieces to be turned by the means 18. The workpieces are supported so as to be capable of being turned in a generally annular useful work zone within the bowl 12, approximately mid-way between the center of the bowl 12 and the outer radial limit of the bowl 12. The housings 30 are designed to be swung into and out of the operating position in which they appear in FIG. 1 to permit the machine operator to load and unload the workpieces conveniently. Additional workpiece turning means (not shown), similar to the workpiece turning means 18, may be provided in spaced positions around the bowl 12. Owing to the violent dispersion of the mass of abrasive finishing media 14 occurring during operation of the rotary finishing machine 10, it is preferred that no more than three workpieces be finished at one time in the rotary finishing machine 10.

Means (not shown) may be provided for introducing washing liquid, such as a solution of detergent in water, into the bowl 12 during rotation of the bowl 12. Preferably, such means are in the form of spray heads arranged to spray washing liquid onto the workpieces to be turned by the aforementioned workpiece turning means 18.

The rotary finishing machine 10 further generally comprises an outer stationary protective housing 36 which serves to confine matter discharged from the bowl 12 during operation of the machine 10. The housing 36 also serves to protect the machine operator from injury caused by rotation of the bowl 12 or discharge of matter from the bowl 12. The housing 36 defines a trough 38 to which matter discharged from the bowl 12 falls. The trough 38 carries such matter to a drain 40. The housing 36 is designed in multiple interfastened sections (not shown) and is capable of being disassembled to give access to the bowl 12.

The aforementioned bowl rotating means 16, the workpiece turning means 18, the washing liquid introducing means (not shown), and the outer stationary protective housing 36 are conventional in rotary finishing machines. Further details thereof are outside the scope of the present disclosure and may be supplied readily by those skilled in the art.

The bowl 12 comprises a generally cylindrical wall 50 and a generally circular bottom wall 52 integral with the wall 50. Preferably, the wall 50 has a plurality of similar spaced screen openings 54, each of which extends approximately to the bottom edge 56 of the wall 50, and the bowl 12 further comprises a plurality of similar removable screen panels 58, each of which is provided with a multiplicity of uniform perforations 60 of suitable size. Each of the screen panels 58 is positioned so as to cover one of the screen openings 54 and is suitably held in place with respect to the wall 50. Further details of the screen panels 58 are set forth in the co-pending application of Achille K. Ferrara, Ser. No. 800,387 filed Feb. 19, 1969 and assigned to the assignee of the present invention. Alternatively, a lower portion of the wall 50 itself may be provided with a multiplicity of uniform enlarged perforations, and screen cloth or the

like of suitable mesh size may be wrapped around the perforated portion of the wall 50 and suitably fastened in place.

The perforated screen panels 58, if used, or the perforated portion of the wall 50, if used, serves to screen the mass of abrasive finishing media 14 so as to permit radially outward discharge of abrasive fines and retain the remainder of the mass of abrasive finishing media. Other waste materials and washing liquid are discharged with the abrasive fines.

For the sake of revealing details of the construction of the bowl 12, FIG. 1 shows the mass of abrasive finishing media 14 in a generally level condition. It should be understood that during rotation of the bowl 12 centrifugal action tends to cause the mass of abrasive finishing media 14 to become concentrated against the generally cylindrical wall of the bowl 12, in the manner suggested in phantom outline 14' in FIG. 1.

During rotation of the bowl 12 in a counterclockwise direction as viewed in FIG. 2, the media particles which strike the workpieces are violently disturbed and, depending on the shapes of the workpieces, may be broadcast in plural directions throughout the bowl 12. Upon impact with the workpieces during rotation of the bowl 12, some of the media particles may be driven generally radially inwardly toward the center of the bowl 12. Furthermore, as mentioned, centrifugal action tends to cause the mass of abrasive finishing media to become concentrated against the generally cylindrical wall 50, in the manner suggested in phantom outline 14 in FIG. 1. As a result, a void tends to be formed in the mass of abrasive finishing media 14 at the center of bowl 12. The media particles tend to migrate generally radially outwardly from the center of the bowl 12 and generally upwardly along the generally cylindrical wall 50. A limited amount of peripheral displacement of the media particles may be observed.

In accordance with the principles of this invention, the bowl 12 further comprises means for recirculating the mass of abrasive finishing media around the workpieces during rotation of the bowl 12. Such recirculating means generally comprises a radially inwardly extending peripheral flange 70, integral with the generally cylindrical wall 50 at the upper periphery 72 of the wall 50, and an upright hub 74, integral with the bottom wall 52 and coaxial with the bowl 12. The flange 70 and the hub 74 serve to recirculate media particles which move away from the workpieces during rotation of the bowl, either toward the center of the bowl, as a result of impact with the workpieces, or generally upwardly along the generally cylindrical wall, under centrifugal action.

As is evident from FIG. 1, the flange 70 is concave-curved relative to the bowl 12. The flange 70 thereby is adapted to recirculate media particles which move generally upwardly along the generally cylindrical wall 50 past the upper periphery 72 of the wall 50 during rotation of the bowl 12. Because the flange 70 is concave-curved relative to the bowl 12, rather than straight and at right angles or acute angles to the wall 50, media particles which are pushed beyond the upper periphery 72 of the wall 50 are not blocked thereby, or entrapped therebeneath, but are permitted further upward movement wherein they are deflected radially inwardly by the flange 70, until they become clear of the underlying built-up media particles and as a result drop back to the useful work zone.

The flange 70 extends radially inwardly to an inner edge portion 76 which is directed downwardly toward the bowl 12 to deflect highly energized media particles back to the mass of abrasive finishing media 14.

In at least partially filling the void which tends to be formed in the mass of abrasive finishing media 14 at the center of the bowl 12, the hub 74 permits the media particles to be maintained in the useful work zone at a sufficient depth to effectively finish all portions of the work-

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pieces with a smaller charge or mass than would be necessary if the hub 74 were to be omitted.

As is evident from FIG. 1, the hub 74 is fabricated with a concave-curvilinear side wall 78 adapted to deflect media particles driven toward the hub 74 upon impact with the workpieces during rotation of the bowl 12. The side wall 78 curves inwardly from the upper edge 80 of the hub 74, as shown, to minimize loss of highly energized media particles driven generally radially inwardly with inclined trajectories upon impact with the workpieces during rotation of the bowl 12. Media particles striking the side wall 78 of the hub 74 cannot pass across the center of the bowl 12 but are deflected back to the useful work zone.

The location of the hub 74 in an upright position coaxial with the bowl 12 permits the upright driving shaft 24a of the aforementioned speed reducer 24 to be extended upwardly into the bowl 12, through a suitable opening (not shown) in the bottom wall 52 and into a suitable receptacle or socket 74a with which the hub 74 has been fabricated. This arrangement improves the stability of the bowl 12 in rotation, substantially reducing the tendency of the bowl 12 to wobble when rotating under an unbalanced load and thus promoting longer useful lives for the speed reducer 24 and the other moving parts of the rotary finishing machine 10.

Modifications and variations within the scope of this invention will be suggested by this disclosure to those skilled in the art. Accordingly, the scope of this invention should be determined from the following claims.

I claim:

1. A rotary finishing machine comprising, in combination, a rotatable bowl adapted to contain a mass of abrasive finishing media, means for rotating said bowl, and means for turning workpieces in the path of said mass of abrasive finishing media during rotation of said bowl, said bowl including a generally cylindrical wall, a bottom wall integral with said generally cylindrical wall and recirculating means for recirculating said mass of abrasive finishing media around said workpieces during rotation of said bowl.

2. The rotary finishing machine of claim 1 wherein said recirculating means comprises a radially inwardly extending peripheral flange integral with said generally cylindrical wall at the upper periphery of said generally cylindrical wall, said flange being concave-curvilinear relative to said bowl and being thereby adapted to recirculate abrasive finishing media which move generally upwardly along said generally cylindrical wall past the upper periphery of said generally cylindrical wall during rotation of said bowl.

3. The rotary finishing machine of claim 2 wherein said flange extends radially inwardly to an inner edge portion directed downwardly toward said bowl.

4. The rotary finishing machine of claim 1 wherein said recirculating means comprises an upright hub integral with said bottom wall and coaxial with said bowl.

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5. The rotary finishing machine of claim 4 wherein said hub has a concave-curvilinear side wall adapted to recirculate abrasive finishing media driven toward said hub upon impact with said workpieces during rotation of said bowl.

6. The rotary finishing machine of claim 4 wherein said means for rotating said bowl comprises an upright driving shaft extended upwardly into said bowl and said hub has a socket adapted to receive said upright driving shaft.

7. The rotary finishing machine of claim 6 wherein said hub has a concave-curvilinear side wall adapted to recirculate abrasive finishing media driven toward said hub upon impact with said workpieces during rotation of said bowl.

8. The rotary finishing machine of claim 1 wherein said recirculating means comprises a radially inwardly extended peripheral flange integral with said generally cylindrical wall at the upper periphery of said generally cylindrical wall and an upright hub integral with said bottom wall and coaxial with said bowl.

9. The rotary finishing machine of claim 8 wherein said flange is concave-curvilinear relative to said bowl and is thereby adapted to recirculate abrasive finishing media which move generally upwardly along said generally cylindrical wall past the upper periphery of said generally cylindrical wall during rotation of said bowl.

10. The rotary finishing means of claim 8 wherein said hub has a concave-curvilinear side wall adapted to recirculate abrasive finishing media driven toward said hub upon impact with said workpieces during rotation of said bowl.

11. The rotary finishing machine of claim 8 wherein said flange is concave-curvilinear relative to said bowl and is thereby adapted to recirculate abrasive finishing media moved generally upwardly along said generally cylindrical wall past the upper periphery of said generally cylindrical wall during rotation of said bowl, and wherein said hub has a concave curvilinear side wall adapted to recirculate abrasive finishing media driven toward said hub upon impact with said workpieces during rotation of said bowl.

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