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ROTARY FINISHING MACHINE HAVING REMOVABLE SCREEN PANELS

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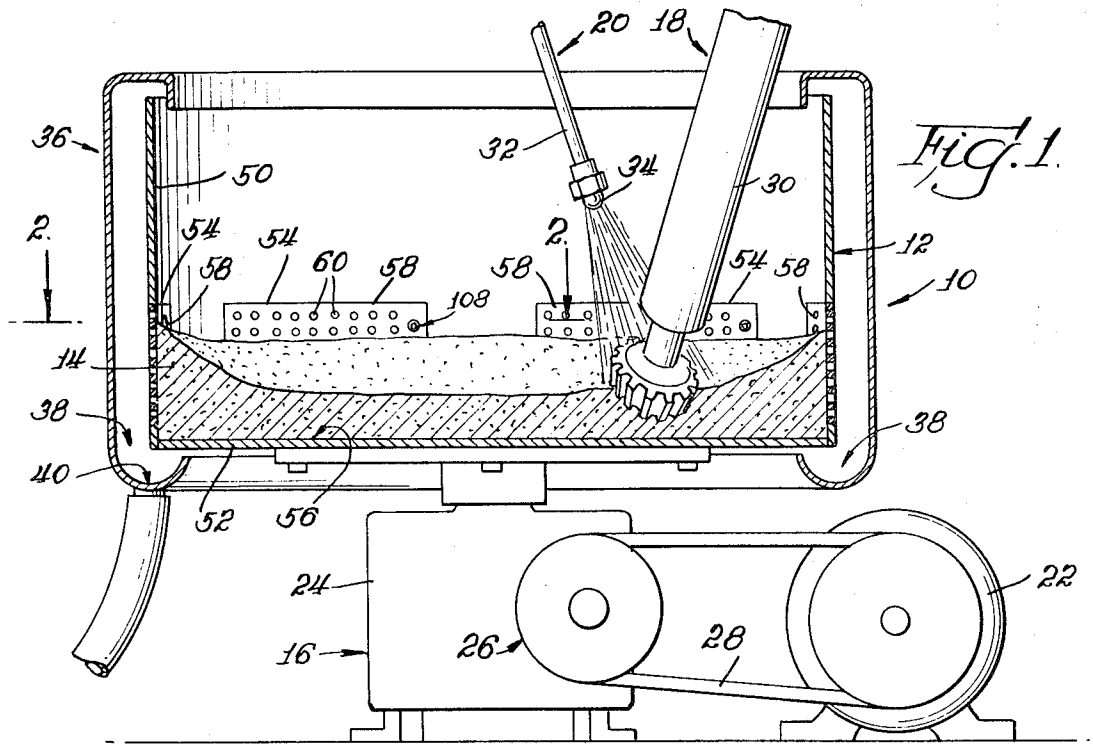


Fig. 1.

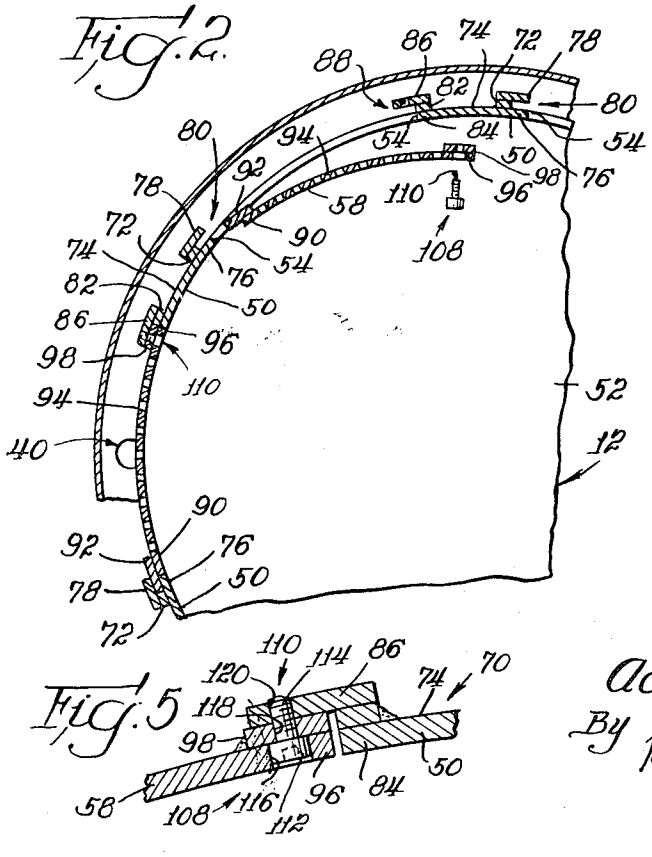


Fig. 2.

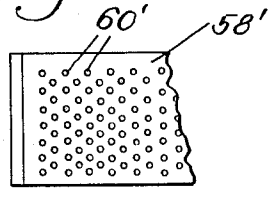


Fig. 3.

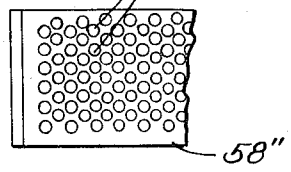


Fig. 4

Fig. 5

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ROTARY FINISHING MACHINE HAVING REMOVABLE SCREEN PANELS

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ABSTRACT OF THE DISCLOSURE

In a rotary finishing machine of the type comprising a rotatable bowl adapted to contain a mass of abrasive finishing media, a plurality of removable screen panels are used to cover screen openings in the lateral wall of the bowl. The screen panels may be removed for cleaning. Selection is permitted among screen panels having perforations of various sizes according to the size and type of abrasive finishing media to be used in a give machine operation.

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 work pieces 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 comprises a generally cylindrical wall and a generally circular bottom integral with the wall. In at least a lower portion of the wall, a multiplicity of uniform perforations are provided. Provision is made to externally wrap the perforated portion of the wall with screen cloth which then is held in place with steel straps or other suitable holding devices.

The combination of the perforations in the wall of the bowl and screen cloth is used because screen cloth alone would be in capable of withstanding the centrifugal force of the rotating mass of abrasive finishing media. Screen cloth is externally wrapped upon the perforated portion of the wall, rather than lined within the perforated portion of the wall, subjecting the screen cloth to the abrasive action of the mass of abrasive finishing media.

The mesh size of the screen cloth is selected in accordance with the size and type of abrasive finishing media to be used in a given operation, fine-meshed screen cloth being used with fine grits, and large-meshed screen cloth being used with large chips. In order to accommodate both fine-meshed screen cloth and large-meshed screen cloth, the perforations in the wall are generally of the order of ¼" in diameter or larger.

Conventionally, washing liquid, such as a solution of detergent in water, is introduced into the bowl during rotation of the bowl through a spray head or the like. The washing liquid helps to remove the abrasive fines and other waste material. The perforated portion of the bowl permits abrasive particles smaller in size than the perforations to impinge upon the screen cloth and retains the remainder of the charge or mass of abrasive finishing media within the bowl. The screen cloth screens the impinging particles and permits radially outward discharge of abrasive

fines and other waste materials. Excess washing liquid is similarly discharged. The mass of abrasive finishing media is replenished from time to time during the operation of the machine to replace abrasive finishing media lost by fragmentation and discharge.

Conventionally, the discharged matter is contained within an outer stationary protective housing and falls to a trough beneath from which it is carried to a drain. The housing also serves to protect the machine operator from injury caused by rotation of the bowl or discharge of matter from the bowl. The housing is capable of being removed or disassembled to give access to the screen cloth and to the steel straps or other holding devices used to hold the screen cloth in place around the perforated portion of the wall of the bowl.

After continued operation of the machine, the meshes of the screen cloth tends to become clogged with abrasive fragments that are too small to be retained by the perforated portion of the wall of the bowl and too large to be discharged through the screen cloth, and the perforations in the wall tend to become clogged with abrasive fragments that are too large to pass therethrough. If the meshes of the screen cloth become clogged excessively, the machine must be shut down and the screen cloth temporarily removed for cleaning or replaced. If the perforations in the wall become clogged excessively, the machine must be shut down, the screen cloth temporarily removed, the abrasive finishing media swept away from the wall or temporarily removed from the bowl, and the perforations in the wall cleaned by means of wire brushes or other implements. Furthermore, from time to time, in normal machine maintenance, the screen cloth must be temporarily removed or replaced and the perforations in the wall must be cleaned.

As mentioned, removal or disassembly of the outer stationary protective housing is necessary to give access to the screen cloth and to the steel straps or other holding devices used to hold the screen cloth in place around the perforated portions of the wall of the bowl. Usually, the screen cloth is temporarily removed for cleaning. On one hand, cleaning of screen cloth, particularly small-meshed screen cloth, is usually done with wire brushes and is tedious, but, on the other hand, frequent replacement of screen cloth is needlessly expensive and is not preferred.

Cleaning of the perforations in the lateral wall is difficult and time-consuming. The personnel involved are required to reach over the top edge of the bowl to work with wire brushes or other implements near the bottom of the wall.

This invention is addressed to the alleviation of the problems of machine maintenance alluded to in the foregoing discussion.

SUMMARY OF THE INVENTION

It is an object of this invention to provide 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 work-pieces in the path of the mass of abrasive finishing media, in which machine cleaning of the screening elements is greatly simplified.

It is another object of this invention to provide a rotary finishing machine, of the aforementioned type, in which the need for screen cloth is eliminated.

It is a more particular object of this invention to provide, in a rotary finishing machine of the aforementioned type, a rotatable bowl comprising a plurality of removable screen panels each of which is provided with a multiplicity of uniform perforations.

Each of the screen panels is positioned to cover one of a plurality of screen openings in the generally cylindrical

wall of the bowl. The screen openings extend approximately to the bottom edge of the wall. During rotation of the bowl, centrifugal force serves to hold the screen panels in place against suitable flange means integral with the wall of the bowl at the margins of the screen openings. Thus, the screen panels are supported against radially outward and circumferential displacement with respect to the wall of the bowl. Preferably, fastening means are provided for detachably fastening the screen panels to the flange means.

The screen panels are adapted to screen the mass of abrasive media so as to permit radially outward discharge of abrasive fines and excess washing liquid and retain the remainder of the mass of abrasive finishing media.

These and other objects, features and advantages of this invention are evident in the following description, with the aid of the accompanying drawings, of the presently 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;

FIG. 2 is a sectional view, partly fragmented, taken substantially along section line 2—2 of FIG. 1 in the direction of the arrows, showing the rotatable bowl of the rotary finishing machine with one of the component screen panels being put in place;

FIG. 3 is a detail view of a fragmentary portion of a screen having fine perforations;

FIG. 4 is a detail view of a fragmentary portion of a screen panel having large perforations; and

FIG. 5 is a detail view on an enlarged scale, in section and fragmented, of exemplary fastening means for detachably fastening the screen panels in place.

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**, means **18** for turning workpieces in the path of the mass of abrasive finishing media **14**, and means **20** for introducing washing liquid, such as a solution of detergent in water, into the bowl **12** during rotation of the bowl **12**.

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 and comprises a generally cylindrical housing **30** supporting a suitable chuck or collet (not shown) by means of which a variety of workpieces may be held. In FIG. 1, a casting for a bevel gear is shown as an exemplary workpiece to be turned by the means **18**. The housing **30** is designed to be swung into and out of the operating position in which it appears 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 position 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**.

The means **20** for introducing washing liquid, such as a solution of detergent in water, into the bowl **12** during

rotation of the bowl **12** comprises a conduit **32** connected to a source (not shown) of washing liquid and a spray head **34** positioned to spray washing liquid onto the workpieces to be turned by the aforementioned workpiece turning means **18**. Additional spray heads (not shown) similar to the spray head **34** would be provided if additional workpiece turning means were to be provided as mentioned above.

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 **12** 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 **20**, and the outer stationary protective housing **36** are conventional in rotary finishing machines. Further details thereof are outside of 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 **52** integral with the wall **50**. In accordance with the principles of this invention, 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**. Each of the screen panels **58** is positioned so as to cover one of the screen openings **54** and is supported, in a manner to be described next, against radially outward and circumferential displacement with respect to the wall **50**.

The manner in which the screen panels **58** preferably are supported against radially outward and circumferential displacement with respect to the wall **50** of the bowl **12** is best shown in FIGS. 2 and 5. In FIG. 2, one of the screen panels **58** is shown as being fully in place, another of the screen panels **58** is shown as being put in place, and another of the screen panels **58** is omitted.

In FIGS. 2 and 5, it may be seen that the bowl **12** further comprises flange means **70** for supporting the screen panels **58** against radially outward and circumferential displacement with respect to the screen openings **54**. The flange means **70** respectively comprise a first spacer element **72** integral with the wall **50** of the bowl **12** on the outer surface **74** of the wall **50** a short distance removed from one vertical margin **76** of one of the screen openings **54**, a first flange member **78** integral with the first spacer element **72** and spaced thereby from the wall **50** so as to define a marginal slot **80** between the first flange member **78** and a portion of the wall **50**, a second spacer member **82** integral with the wall **50** on the outer surface **74** of the wall **50** flush with the opposite vertical margin **84** of the same one of the screen openings **54**, and a second flange member **86** integral with the second spacer element **82** and spaced thereby from the wall **50** so as to define a marginal recess **88**.

In order that the screen panels **58** may be supported flush with the wall **50**, the vertical edges **90** of the screen panels **58** which are respectively associated with the first-mentioned vertical margins **76** of the screen openings **54** are provided with integral flange members **92** on the outer surfaces **94** of the screen panels **58**, and the opposite vertical edges **96** are provided with integral spacer members **98** flush therewith on the outer surfaces **94** of the screen panels **58**. When the screen panels **58** are properly

placed, the flange members **92** fit into the marginal slots **80**, the spacer members **98** fit into the marginal recesses **88**, and the vertical edges **90** and **96** of the screen panels **58** lie between the vertical margins **76** and **84** of the screen openings **54**.

During rotation of the bowl, the centrifugal force of the screen panels **58**, augmented by the centrifugal force of the mass of abrasive finishing media **14** serves to hold the screen panels **58** in place against the flange means **70**. The flange members **92** on the screen panels **58** bear against the flange members **78** on the wall **50**, and the spacer members **98** on the screen panels **58** bear against the flange members **86** on the wall **50**. Also, as mentioned above, the vertical edges **90** and **96** of the screen panels **58** lie between the vertical margins **76** and **84** of the screen openings **54**. Thus, the screen panels **58** are supported against radially outward and circumferential displacement with respect to the wall **50**. It is not necessary to fasten the screen panels **58** to the wall **50**. However, in order that a unitary assembly be obtained, it is preferred that suitable fastening means **108** be provided for detachably fastening the screen panels **58** to the flange means **70**.

As shown best in FIG. 5, the fastening means **108** comprises respective studs **110** of the type having an enlarged recessed head **112** and an elongated threaded shank **114**. The heads **112** of the respective studs **110** are rotatably recessed within enlarged openings **116** in the screen panels **58** a short distance removed from the second-mentioned vertical margins **96** of the screen panels **58**, and the shanks **104** of the respective studs **110** pass through suitable unthreaded openings **118** in the adjacent spacer members **98** and threadably engage suitable threaded openings **120** in the second flange members **86** of the aforementioned flange means **70**. Preferably, one such stud **110** is used near the top of each screen panel **58**. However, one or more similar studs may be used in addition thereto for each screen panel **58**.

Because the studs **110** are installed and de-installed from the inside of the bowl **12**, there is no need to disassemble the aforementioned outer stationary protective housing **36** before removing the screen panels **58**.

Because the screen panels **58** are installed flush with the wall **50** of the bowl **12**, and because the heads **112** of the studs **110** are recessed, as mentioned, the bowl **12** is substantially smooth and free of projections which might interfere with the mass of abrasive finishing media **14**. Likewise, the abrasive action of the mass of abrasive finishing media **14** on the screen panels **58** and on the heads **112** of the studs **110** is minimized.

Cleaning of the perforations **60** in the screen panels **58** is greatly simplified by the removal of the screen panels **58**. Thus, it is preferred that duplicate sets of similar screen panels be at hand in order that the downtime of the rotary finishing machine **10** thereby might be minimized. If and when the perforations in the screen panels **58** become clogged excessively with abrasive particles that are too large to pass therethrough, the machine **10** is shut down, the mass of abrasive finishing media **14** swept away from the wall **50** or temporarily removed from the bowl **12**, and the screen panels **58** removed and replaced by the duplicate screen panels. Thereafter, the removed screen panels **58** may be cleaned while the machine **10** is back in operation.

In the present example, in the lateral wall **50**, the screen openings **54** are six in number, four of them appearing in whole or in part in FIG. 1. Accordingly, six screen panels are required for operation of the rotary finishing machine **10**. Each of the six screen panels to be used together should have perforations of the same size. However, screen panels having perforations of any practicable size may be used, there being no need for screen cloth or other additional screening elements.

It may be assumed that the perforations **60** in the screen panels **58** of FIGS. 1 and 2 are of the order of ⅛" in diameter. FIG. 3 illustrates a screen panel **58'**, interchangeable with any of the screen panels **58**. The screen panel **58'** is provided with a multiplicity of uniform perforations **60'** which may be assumed to be of the order of 1/16" in diameter. FIG. 4 illustrates a screen panel **58"**, also interchangeable with any of the screen panels **58**. The screen panel **58"** is provided with a multiplicity of uniform perforations **60"** which may be assumed to be of the order of ¼" in diameter.

The foregoing perforation dimensions are exemplary. Conceivably, screen panels (not shown) having perforations that are smaller than the perforations **60'** in the screen panel **58'** or larger than the perforations **60"** in the screen panel **58"** might be used.

Selection is made among screen panels having perforations of various sizes in accordance with the size and type of abrasive media to be used in a given operation, screen panels having small perforations being used with fine grits, and screen panels having large perforations being used with large-size chips. The screen panels **58** of FIGS. 1 and 2 are used with intermediately sized chips.

It should be understood that the foregoing description of the presently preferred embodiment of this invention is given solely by way of example and that numerous changes within the scope of this invention may be suggested by the present 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 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 comprising a generally cylindrical wall having a plurality of spaced screen openings each of which extends approximately to the bottom edge of said wall, a generally circular bottom integral with said wall, and a plurality of removable screen panels each of which is provided with a multiplicity of uniform perforations, each of said screen panels being positioned so as to cover one of said screen openings and being supported against radially outward and circumferential displacement with respect to said wall, said screen panels being adapted to screen said mass of abrasive media so as to permit radially outward discharge of abrasive fines and retain the remainder of said mass of abrasive finishing media.

2. The rotary finishing machine of claim **1** wherein said bowl further comprises flange means for supporting said screen panels against radially outward and circumferential displacement with respect to said wall, said flange means being integral with said wall and extending from the margins of said screen openings.

3. The rotary finishing machine of claim **2** wherein said bowl further comprises fastening means for detachably fastening said screen panels to said flange means.

4. The rotary finishing means of claim **1** wherein said screen panels are detachably fastened to said wall.

5. The rotary finishing means of claim **4** wherein said bowl further comprises flange means for supporting said screen panels against radially outward and circumferential displacement with respect to said wall and fastening means for detachably fastening said screen panels to said flange means, said flange means being integral with said wall and extending from the margins of said screen openings.

6. The rotary finishing machine of claim **1** further comprising means for introducing washing liquid into said bowl during rotation of said bowl.

7. The rotary finishing machine of claim **6** wherein said bowl further comprises flange means for supporting said screen panels against radially outward and cir-

cumferential displacement with respect to said wall, said flange means being integral with said wall and extending from the margins of said screen openings.

8. The rotary finishing machine of claim **7** wherein said bowl further comprises fastening means for detachably fastening said screen panels to said flange means.

9. The rotary finishing means of claim **6** wherein said screen panels are detachably fastened to said wall.

10. The rotary finishing means of claim **9** wherein said bowl further comprises flange means for supporting said screen panels against radially outward and circumferential displacement with respect to said wall and fastening means for detachably fastening said screen panels to said flange means, said flange means being integral with said wall and extending from the margins of said screen openings.

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U.S. Cl. X.R.

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