

March 9, 1965

L. A. WILLIAMS
GRINDING MACHINE

3,172,831

Filed June 15, 1960

2 Sheets-Sheet 1

Fig. 1.

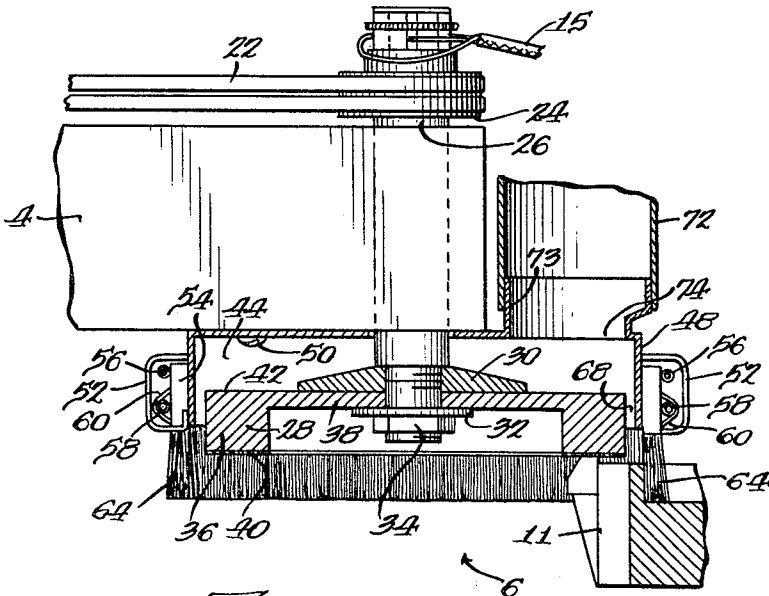
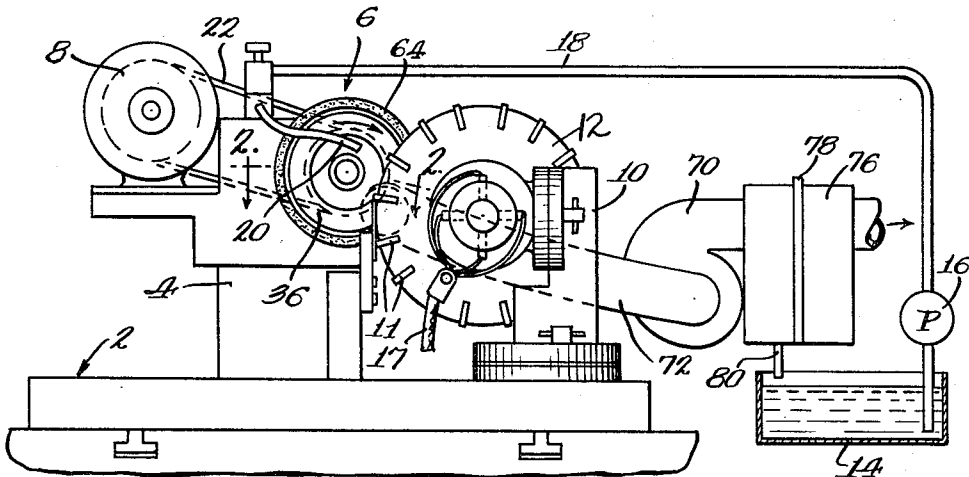


Fig. 2.

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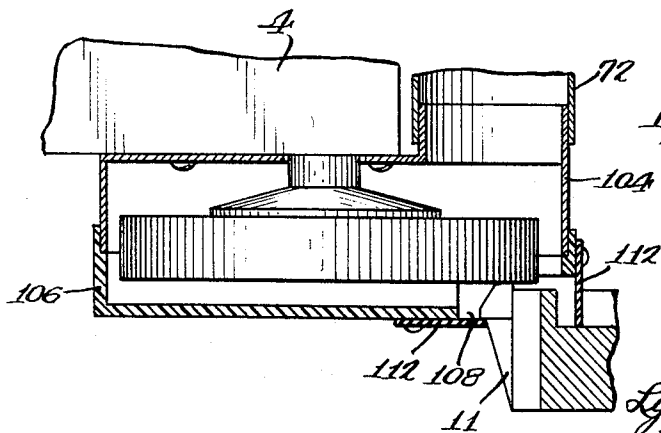
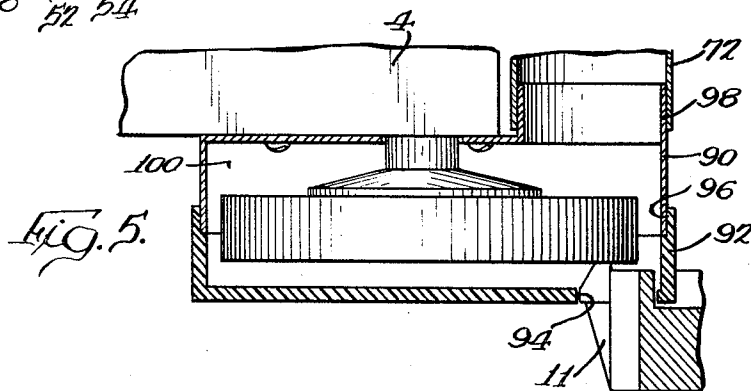
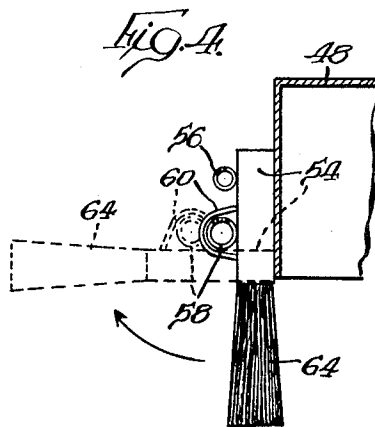
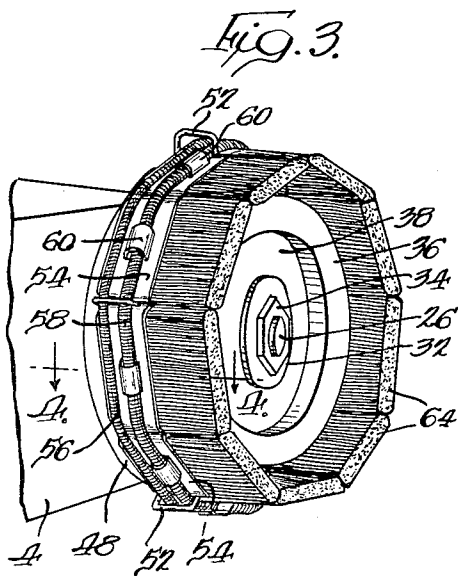
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GRINDING MACHINE

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4 Claims. (Cl. 204-212)

This invention relates generally to grinding machines, and more particularly to means for preventing the discharge of a liquid coolant or electrolyte to the adjacent atmosphere in mist and spray form.

The present invention is particularly adapted for use with electrolytic grinding apparatus of the type shown in U.S. Patent No. 2,826,540, issued to George F. Keeler on March 11, 1958. However, it is to be understood that the invention is not to be limited thereto.

In electrolytic grinding apparatus of this type a liquid electrolyte is introduced between an electrode and a conductive workpiece which is to be shaped. The electrolyte in most instances forms both a mist and a very wet spray because of the very high speed of rotation of the electrode.

The escape of this spray and mist to the adjacent atmosphere is undesirable for many reasons. For example, if the spray should become attached to the clothes of the machine operator, skin irritation and/or damage to the operator's clothes may result. The electrolyte is often corrosive and will cause damage to the machine. In addition, the mist should not collect in the air which is being breathed by an operator. Another important reason is that the loss of electrolyte is messy and costly.

In other types of mechanical grinding, similar problems arise with respect to the coolant fluid used. In either event, it is desirable that means be provided for effectively preventing the loss of electrolyte or coolant into the adjacent atmosphere.

Accordingly, it is a primary object of the present invention to provide in grinding apparatus an improved low cost means for substantially preventing the escape of electrolyte or coolant fluid into the adjacent atmosphere in the form of mist or spray.

It is another object of the present invention to provide improved means for preventing the loss of electrolyte in an electrolytic grinding process.

It is another object of the present invention to provide an improved shroud surrounding the grinding wheel and to provide a source of vacuum adjacent the shroud for draining off the mist, the spray, and the droplets of electrolyte or coolant fluid, and to provide means to coalesce the spray and mist for return to a source or reservoir from which it was originally provided.

A feature of the present invention is the use of an annulus of nylon bristle brushes in one embodiment in a shroud assembly for preventing the escape of electrolyte or coolant fluid in the form of spray or mist. In this embodiment, brushes have the handles cut off. The brushes are then resiliently secured to a shroud surrounding the electrode by means of a pair of annular helical coil springs. Each individual brush is pivotally secured to one of the springs for movement to an angle 90° from its original position to permit the entry of the workpiece.

Other objects and various features of the invention will be appreciated upon a perusal of the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a diagrammatic view of the improved apparatus;

FIG. 2 is a sectional view along line 2-2 of FIG. 1 showing the electrode and the improved brush and shroud structure;

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FIG. 3 is a perspective view more clearly illustrating the improved electrode shroud and brush structure;

FIG. 4 is an elevation view along line 4-4 of FIG. 3, illustrating the improved brush structure in its two positions;

FIG. 5 is a sectional view similar to FIG. 2 showing a second embodiment of the invention; and

FIG. 6 is a sectional view similar to FIG. 2 showing a third embodiment of the invention.

Reference may be had to the Keeler patent, No. 2,826,540, for a more thorough discussion of electrolytic grinding apparatus. Briefly, the apparatus includes a machine bench or frame 2. A first post 4 is carried by the frame for carrying an electrode structure 6 and its driving motor 8. A second post 10 is carried by the frame and supports a multiple position tool holder 12.

The tool holder 12 may be any one of a number well known in the art. The holder is slotted at circumferentially spaced positions for receiving a plurality of conductive tools or workpieces 11. Together this assembly may constitute a milling cutter with carbide tipped blades.

A source or reservoir of electrolyte 14 is provided. A liquid pump 16 delivers electrolyte from the source to the electrode by way of a supply line 18, the end 20 of which directs the fluid onto the wheel and thus into the space between the electrode and the workpiece being shaped as described in the above-mentioned Keeler patent.

In the grinding process, the electrode is made cathodic and the workpiece anodic. A direct current potential is applied across the electrode and workpiece by way of cables 15 and 17. The workpiece is brought into close proximity—for example, .001"—with the conductive working face of the electrode for removal of workpiece material by electrolysis. Frequently the electrode includes insulating or abrasive elements projecting a uniform distance from its conductive working face to establish the desired workpiece and electrode spacing when the workpiece engages the elements.

The motor 8 drives the electrode assembly 6 by means of belts 22. The belts rotate a pulley 24 (FIG. 2). The pulley is, in turn, secured to a shaft 26 on which an electrode 28 is mounted. A pair of washers 30 and 32 and a nut 34 retain electrode in fixed position on shaft 26. The shaft 26 is rotatably mounted in the post 4 by suitable bearing means (not shown).

The electrode 28 is generally cup-shaped with an annular portion 36 and base portion 38. The lower flat surface 40 of the annular portion 36 comprises the working face of the electrode. The rear face 42 of the electrode forms one wall of a vacuum chamber 44 which will be described in more detail later.

The means for preventing the escape of spray and mist will now be described in detail. FIGS. 2 and 3 show the details of one form this means may take. A generally cup-shaped metallic shroud 48 is secured to the post 4 by means of screws 50. The shroud is mounted in concentric relation with the electrode 28.

A plurality of circumferentially spaced retainer arms 52 are secured to the shroud. A plurality of paint brushes 54 with the handles cut off are positioned around the outer periphery of the shroud. A pair of springs 56 and 58 retain the brushes against the shroud. The springs are retained in place by means of the arms 52.

Each of the brushes includes a generally semicylindrical member 60 secured thereto, through which the spring 58 is passed. As best seen in FIG. 4, the brush 54 may be rotated to a position indicated by dotted lines 62 which is approximately 90° from its normal position. The spring 58 and the element 60 permit this pivotal movement of brush 54. The only brushes which are so pivoted out of their normal axial positions are those through which

entry of the workpiece is made for engagement of the workpiece with the electrode.

The bristles 64 of the brushes extend a short distance—for example, 1/2 inch—beyond the working face of the electrode. When the liquid electrolyte strikes the rapidly rotating electrode, it is impelled off the edge of the wheel outwardly into contact with the brushes. It will be appreciated that the working face as well as other parts of the electrode become covered with the electrolyte, and therefore the spray will appear at all circumferential positions. The bristles, therefore, form an annulus which substantially prevents the escape of the mist and spray produced.

The juxtaposed surfaces of the electrode and the shroud provide a passage 68 which is in communication with the much larger plenum chamber 44 and with the space surrounded by the bristles. The chamber 44 is connected in fluid conducting relation with the inlet of a suction blower 70 by way of a flexible hose 72 and an annular lip 73 defining an opening 74 in the base of the shroud. The output of the suction blower 70 is connected to a chamber 76. The suction blower produces a low subatmospheric pressure in the plenum chamber, which in turn causes a high velocity flow of air from the adjacent atmosphere through the passage 68 and into the plenum chamber, drawing the mist and spray with it.

A filter of any suitable construction 78 is interposed in the chamber 76 adjacent the output of the suction blower. The bottom of the chamber 76 is connected to the reservoir 14 by way of a pipe 80.

In operation, the suction blower 70 produces a subatmospheric pressure in the chamber 44. This area of reduced pressure extends through the passage 68 to the space surrounded by the brushes 64. This area of reduced pressure will cause a flow of air from the adjacent atmosphere, through the passage 68 at a high velocity, into the chamber 44, through the opening 74 and the hose 72, to the blower 70. The high velocity air stream through the passage 68 carries the mist and spray with it. The blower 70 directs the mist and spray against the filter 78 to condense the liquid therefrom. The condensed liquid then flows by means of gravity through the pipe 80 to the source 14.

The lip 73 is preferably formed adjacent the lowermost portion of the shroud. The hose 72 progresses downwardly from the lip 73 to the reservoir 14. The liquid electrolyte which collects in the bottom of the shroud assembly will, therefore, be drawn by suction and gravity through the opening 74 and the hose 72 to the blower 70 for discharge into the chamber 76.

In the embodiment of FIG. 5, the electrode is encircled by a shroud 90 which is similar to shroud 48. In this embodiment, however, the shroud has attached thereto a front cover 92 made preferably of transparent plastic. The front cover is generally cup-shaped, and has an internal annular recess 96 formed in the free end thereof. The free end is press fit on the shroud 90.

The shroud 90 includes a cylindrical lip 98 adapted to be secured to the hose 72. In this embodiment the flow of air from atmosphere will be through the window 94, around the periphery of the electrode into the chamber 100, and thence through the lip 98 and the hose 72 to the suction blower. This flow of air will carry with it the electrolyte in mist, spray, and liquid form. Any liquid electrolyte which flows through the window 94 will fall onto a conventional splash pan (not shown). The electrolyte collected in the splash pan is returned to the reservoir by gravity in the conventional manner. It is desirable to have the window cut so that it closely fits the workpiece to prevent undue escape of fluid.

The embodiment of FIG. 6 is generally similar to that of FIG. 5. It includes a generally cup-shaped shroud 102 having an annular lip 104 to which the hose 72 is connected. A cup-shaped plastic front cover 106 is press

fit on the shroud. A window 108 is provided in the cover to permit entry of the tool 11.

However, in this embodiment, the window is provided with rubber flaps 112 secured to the cover and engaging the workpiece to assure the retention of the spray and mist. In addition, these flaps permit irregular and widely differing tool configurations to be received without impairing the external splatter-free feature of the machine. Bristles similar to those in FIGS. 1-4 may be used in place of the flaps.

While there has been described what is believed to be the preferred embodiment of the present invention, it will be appreciated that various changes and modifications may be made therein; and it is contemplated to cover in the appended claims all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a grinding machine having a rotatable tool provided with abrasive particles on its working face for shaping a workpiece, and means for supplying a liquid from a source to the interface between the tool working face and the workpiece, a liquid collector apparatus, comprising in combination, an annular shroud having a skirt portion surrounding the tool in radially spaced relation thereto and a rear wall portion spaced from the rear of the tool to define a chamber, the forward edge of the shroud skirt portion being positioned axially to the rear of the tool working face, a plurality of bristle bearing units arranged in circumferentially abutting relationship around the outer surface of the shroud skirt portion with the bristles normally projecting beyond the tool working face in the direction of the workpiece to define a bristle ring to prevent the escape to the adjacent atmosphere of liquid mist and spray, resilient means engageable with the bristle bearing units to hold them in position against the shroud skirt portion and to permit them to be selectively individually pivoted so that the bristles project away from the shroud in a plane parallel to and behind the tool working face for entry of the workpiece, and suction means connected to the shroud to draw the mist and spray from the space within the bristle ring and through the annular space between the periphery of the tool and the shroud skirt portion and the chamber behind the tool.

2. In a grinding machine having a rotatable tool provided with abrasive particles on its working face for shaping a workpiece, and means for supplying a liquid from a source to the interface between the tool working face and the workpiece, a liquid collector apparatus, comprising in combination, an annular shroud having a skirt portion surrounding the tool in radially spaced relation thereto and a rear wall portion spaced from the rear of the tool to define a chamber, the forward edge of the shroud skirt portion being positioned axially to the rear of the tool working face, bristle bearing means arranged circumferentially around the outer surface of the shroud skirt portion with the bristles normally projecting beyond the tool working face in the direction of the workpiece to define a bristle ring to prevent the escape to the adjacent atmosphere of liquid mist and spray, spring means holding the bristle bearing means in position against the shroud skirt portion, means pivotally connecting the bristle bearing means to the spring means so that a portion of the bristle bearing means may be selectively pivoted to project the bristles away from the shroud in a plane parallel to and behind the tool working face for entry of the workpiece, and suction means connected to the shroud to draw the mist and spray from the space within the bristle ring and through the annular space between the periphery of the tool and the shroud skirt portion and the chamber behind the tool.

3. In a grinding machine having a rotatable tool provided with abrasive particles on its working face for shaping a workpiece, and means for supplying a liquid from a source to the interface between the tool working face and the workpiece, a liquid collector apparatus,

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comprising in combination, an annular shroud having a skirt portion surrounding the tool in radially spaced relation thereto and a rear wall portion spaced from the rear of the tool to define a chamber, the forward edge of the shroud skirt portion being positioned axially to the rear of the tool working face, a plurality of bristle bearing units arranged in circumferentially abutting relationship around the outer surface of the shroud skirt portion with the bristles normally projecting beyond the tool working face in the direction of the workpiece to define a bristle ring to prevent the escape to the adjacent atmosphere of liquid mist and spray, spring means holding the bristle bearing units in position against the shroud skirt portion, each unit having a retaining member secured thereto and pivotally engageable with the spring means, whereby the unit may be selectively individually pivoted so that the bristles project away from the shroud in a plane parallel to and behind the tool working face for entry of the workpiece, and suction means connected to the shroud to draw the mist and spray from the space within the bristle ring and through the annular space between the periphery of the tool and the shroud skirt portion and the chamber behind the tool.

4. In a grinding machine having a rotatable electrode tool provided with abrasive particles on its working face for shaping a conductive workpiece, and means for supplying a liquid electrolyte from a source to the interface between the electrode tool working face and the workpiece, a liquid collector apparatus, comprising in combination, an annular shroud having a skirt portion surrounding the electrode tool in radially spaced relation thereto and a rear wall portion spaced from the rear

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of the electrode tool to define a chamber, the forward edge of the shroud skirt portion being positioned axially to the rear of the electrode tool working face, a plurality of brushes arranged in circumferentially abutting relationship around the outer surface of the shroud skirt portion with their bristles normally projecting beyond the electrode tool working face in the direction of the workpiece to define a bristle ring to prevent the escape to the adjacent atmosphere of liquid mist and spray produced during the shape of the workpiece, a pair of expandable springs encircling the brushes to hold them in position against the shroud skirt portion, each of the brushes having spring retaining members secured thereto through which one of the springs extends, whereby the brushes may be selectively individually pivoted so that the bristles project away from the shroud in a plane parallel to and behind the electrode tool working face for entry of the workpiece, and suction means connected to the shroud to draw the mist and spray from the space within the bristle ring and through the annular space between the periphery of the electrode tool and the shroud skirt portion and the chamber behind the electrode tool.

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Dedication

3,172,831.—*Lynn A. Williams*, Winnetka, Ill. GRINDING MACHINE. Patent dated Mar. 9, 1965. Dedication filed Dec. 23, 1971, by the assignee, *Anocut Engineering Company*.

Hereby dedicates to the Public the portion of the term of the patent subsequent to Dec. 24, 1971.

[*Official Gazette March 21, 1972.*]