July 1, 1958 S. M. BOOTH 2,840,960

LIQUID FEED FOR A GRINDING WHEEL

Filed Oct. 22, 1956 4 Sheets-Sheet 1

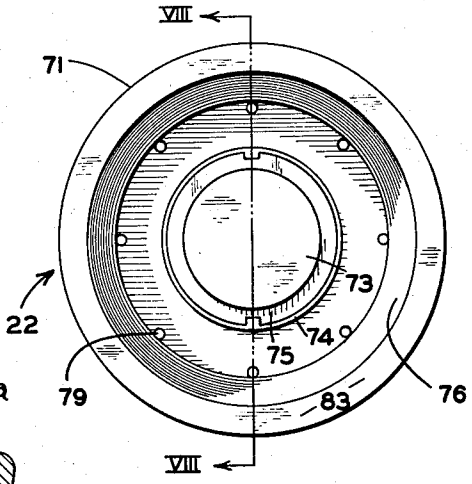

fig. 7

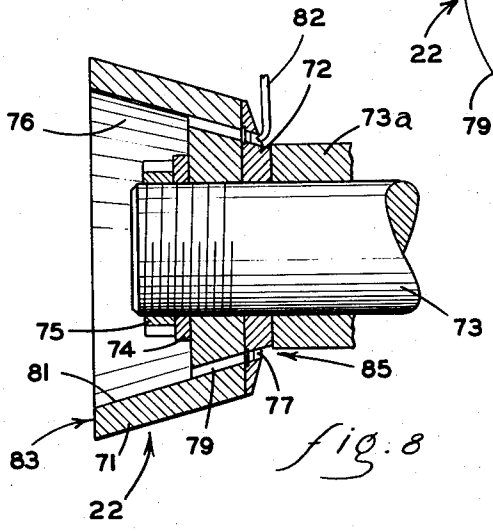

fig. 8

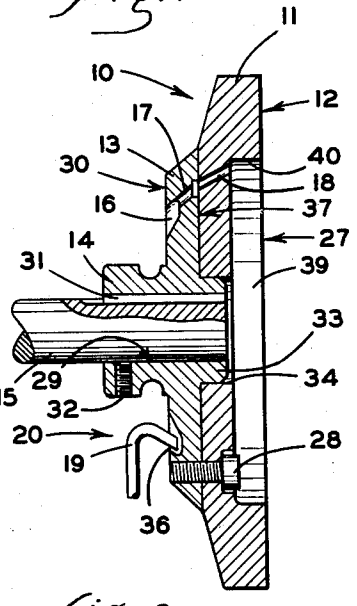

fig. 2

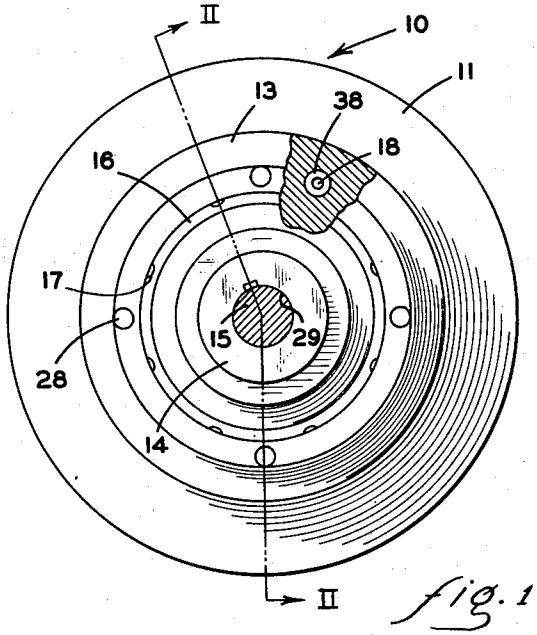

fig. 1

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LIQUID FEED FOR A GRINDING WHEEL

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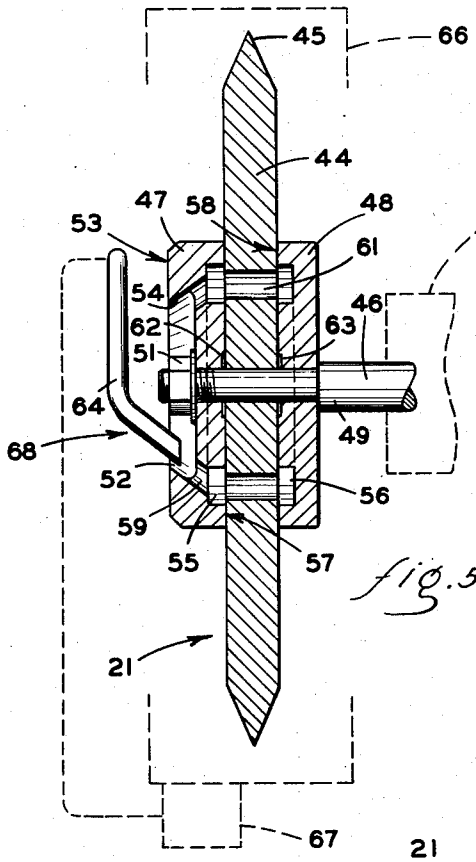

fig. 5

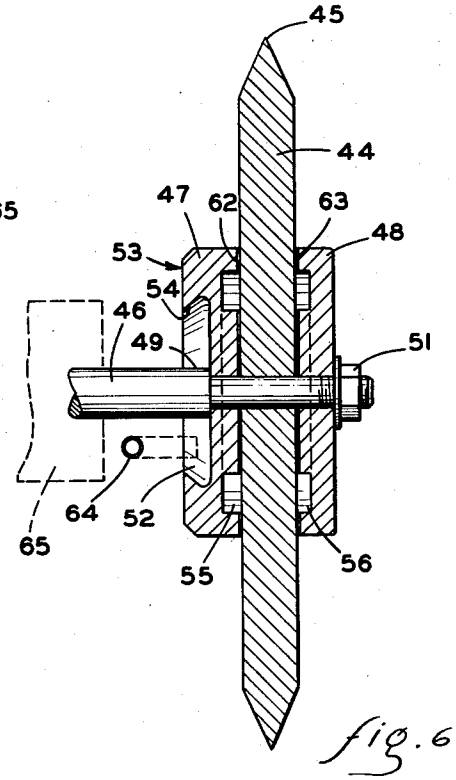

fig. 6

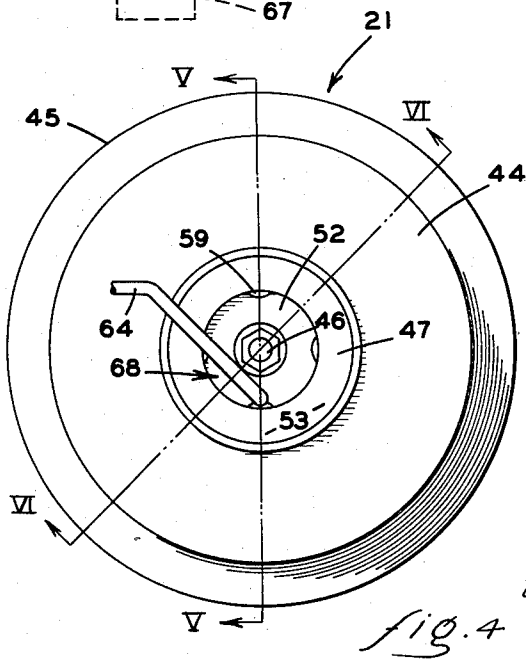

fig. 4

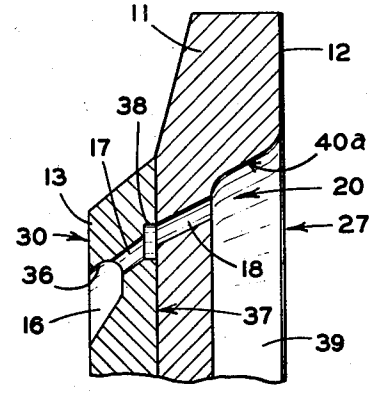

fig. 3

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LIQUID FEED FOR A GRINDING WHEEL

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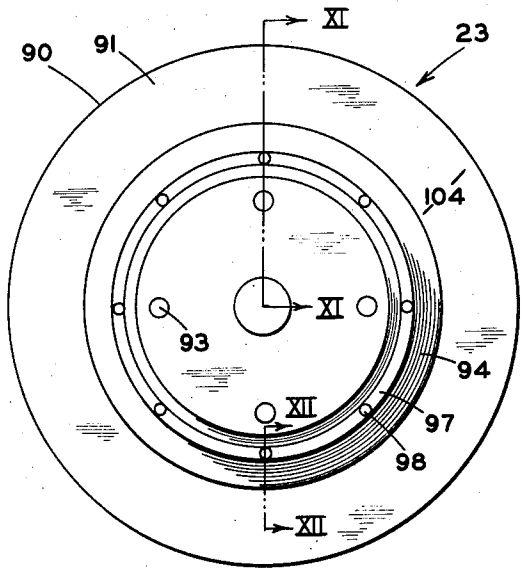

fig. 10

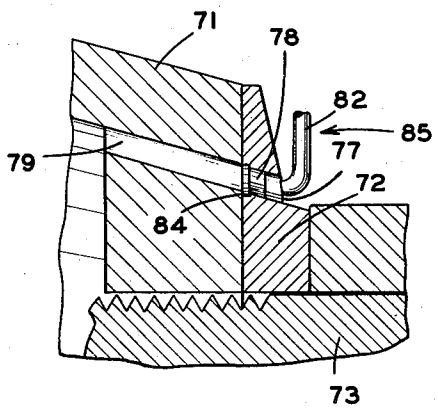

fig. 9

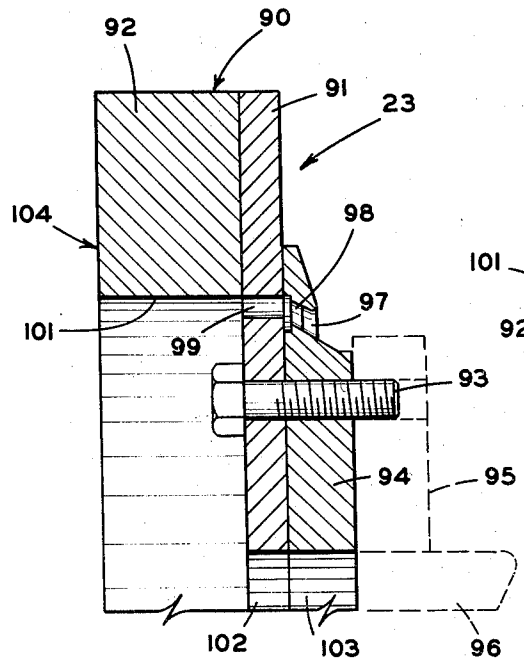

fig. 11

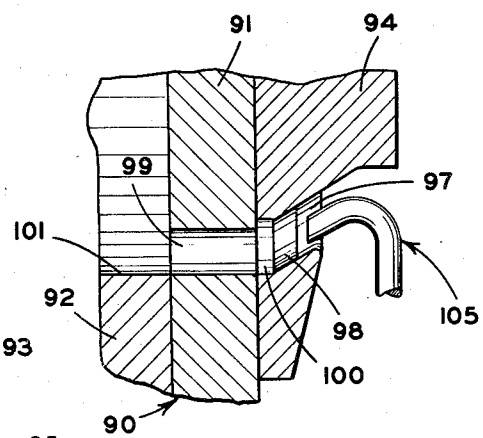

fig. 12

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LIQUID FEED FOR A GRINDING WHEEL

Filed Oct. 22, 1956 4 Sheets-Sheet 4

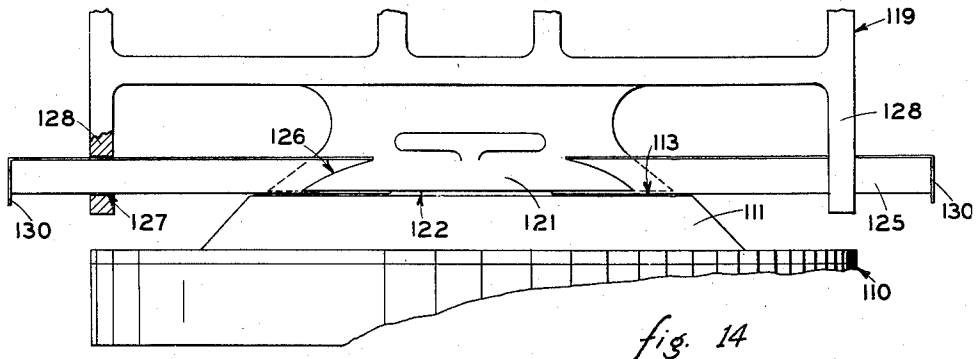

fig. 14

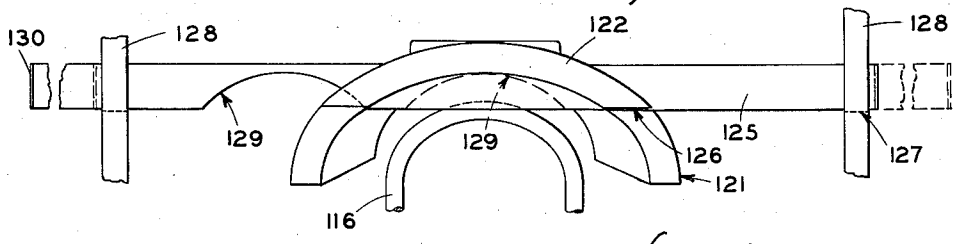

fig. 15

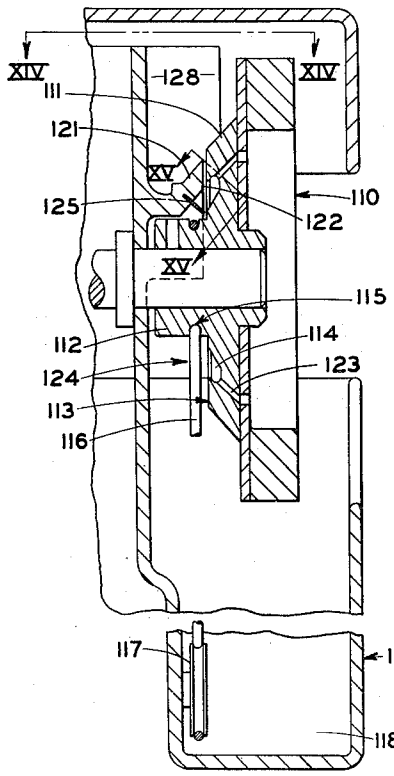

fig. 13

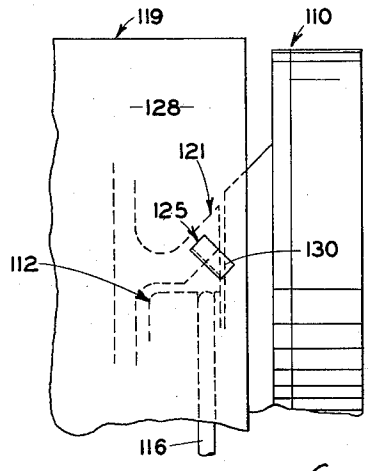

fig. 16

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United States Patent Office 2,840,960 Patented July 1, 1958

2,840,960

LIQUID FEED FOR A GRINDING WHEEL

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Application October 22, 1956, Serial No. 617,616

5 Claims. (Cl. 51—267)

This invention relates in general to a method and apparatus for feeding a liquid, such as a coolant and/or lubricant, to the grinding surface of a grinding wheel and, more particularly, to a type thereof where the steps and the structure required for such feeding can be materially simplified.

In general, there are two well established methods, and numerous devices, whereby a liquid, such as a coolant or a lubricant, can be fed to the grinding surface of a grinding wheel. The first such method requires the use of some type of tube which is directed toward one working face of the grinding wheel, and through which the liquid is urged with sufficient force that it will impinge upon said face of said grinding wheel. The obvious result of this arrangement is the use of excessive amounts of the liquid in order, not only to control the direction of its flow from the tube to the grinding wheel, but also to allow for the fact that much of the liquid will splash off of the adjacent face of the grinding wheel as soon as it strikes it, and, therefore, never reaches the grinding surface. It naturally follows that such excessive amounts of liquid, not only increase the cost of operation, but also impede the use of the grinding wheel under circumstances where small amounts of liquid are not only sufficient but are also better suited to the particular operation to be performed.

Further, in previous practice, the feed tube was adjacent the grinding face, thereby obstructing access to the grinding face and materially reducing the operating efficiency of the grinding wheel. Furthermore, the liquid impinging upon a face-type grinder tends to splash back against the operator and upon the work piece, thereby interfering with the grinding operation.

In the other presently used method of feeding liquid to a grinding wheel, the grinding wheel is mounted upon a hollow shaft, through which the liquid is fed, usually under some pressure, to an inner part of the grinding wheel, from whence the liquid is moved radially to, or along, the grinding surface by centrifugal force. However, in this arrangement, it is not only necessary to provide a special, hollow shaft for the grinding wheel, but it is also necessary to provide special connection means, including a shaft seal or stuffing box of some type, by means of which the source of liquid can be connected to the opening through said shaft. This arrangement necessitates a specially designed machine adapted for such feeding when it is initially manufactured. Also, excessive amounts of liquid must often be moved through the hollow shaft in order to provide a continuous flow of liquid at the grinding surface.

Accordingly, a principal object of this invention is the provision of a method and apparatus for feeding a liquid, such as a coolant or a lubricant, to the grinding surface of a grinding wheel, such method and apparatus being easily adaptable to use either with face-types or peripheral-type of grinding wheels, and which can be easily and quickly adapted to use with presently existing grinding

machines, without effecting any material change in the structure of such machines, providing only that they have some means of collecting and recirculating the liquid.

A further object of the invention is the provision of a liquid feed apparatus, as aforesaid, whereby the amount of liquid reaching the grinding surface can be carefully and accurately controlled; whereby splashing of the liquid, as it is applied to the grinding wheel, can be completely eliminated; and whereby the amount of liquid applied to said grinding surface can be reduced to as low an amount as desired, without impairing in any way the efficiency of the feeding operation, there being no need to feed the liquid under a substantial pressure at any time.

A further object of the invention is the provision of a liquid feeding apparatus, as aforesaid, which can be easily adapted, by minor modification only, to a grinding machine which has not previously been adapted for a liquid-type grinding operation.

A further object of the invention is the provision of a liquid feeeding apparatus, as aforesaid, which is extremely simple in construction and operation; which can be installed inexpensively and easily; which can be fabricated with only slightly more effort than is required to fabricate a present type of grinding wheel and hub therefor without the invention.

A further object of this invention is the provision of a liquid feeding apparatus, as aforesaid, which permits the feeding of said liquid to the grinding surface of a face-type or cup-type grinding wheel, without utilizing a hollow shaft to support the grinding wheel, and without necessitating the use of a feeding tube extending across the face of the grinding wheel.

Other objects and purposes of this invention will become apparent to persons familiar with this type of equipment upon reading the following specification and examining the accompanying drawings, in which:

Figure 1 is a broken, rear elevational view of a face-type grinding wheel embodying the invention.

Figure 2 is a sectional view taken along the line II—II of Figure 1.

Figure 3 is an enlarged fragment of Figure 2, showing a modified shape.

Figure 4 is a side elevational view of a grinding wheel having a peripheral grinding surface and embodying the invention.

Figure 5 is a sectional view taken along the line V—V of Figure 4 and including a schematic showing of a liquid-collecting hood and sump pump therefor.

Figure 6 is a sectional view substantally as taken along the line VI—VI of Figure 4, but showing the shaft in the opposite position from that shown in Figure 5.

Figure 7 is a front elevational view of a cup-type grinding wheel, disclosing an alternate type of liquid feed structure.

Figure 8 is a sectional view taken along the line VIII—VIII of Figure 7.

Figure 9 is an enlarged fragment of Figure 8.

Figure 10 is a rear elevational view of a further alternate structure for a cup-type or face-type grinding wheel embodying the invention.

Figure 11 is a sectional view taken along the line XI—XI of Figure 10.

Figure 12 is a sectional view taken along the line XII—XII of Figure 10.

Figure 13 is a vertical, central cross-sectional view of a grinding member embodying the invention and including an alternate device for delivering the liquid to the member.

Figure 14 is a sectional view taken along the line XIV—XIV of Figure 13.

Figure 15 is a sectional view substantially as taken along the line XV—XV of Figure 13.

Figure 16 is a fragmentary, side elevation view of the structure appearing in Figure 13.

For the purpose of convenience in description, the terms "front," "rear," and derivatives thereof, will have reference to the grinding face and the opposite axial face, respectively, of a face-type or cup-type grinding wheel, such as that appearing in Figure 7. The terms "inner," "outer," and derivatives thereof, will have reference to the axis of rotation of the grinding wheel and associated parts thereof disclosed herein.

GENERAL DESCRIPTION

Since the method of the invention can best be understood in connection with specific apparatus for practicing same, attention will first be directed toward such apparatus. It will be understood, however, that other devices for practicing the method aspects of the invention will be available.

In order to meet the objects and purposes of this invention, I have provided a method by which the desired liquid is supplied to a groove constituting a distribution reservoir in the back side of a grinding wheel. Said liquid is then caused to move through the grinding wheel in response to an axial (with respect to the wheel) force component developed thereon by the centrifugal force to which the liquid is subjected while the wheel is rotating. Said liquid is thereby caused to move as desired to the working face of the wheel. Said liquid is then supplied to the working face of the wheel at the radially inner edge thereof and is caused to move in response to centrifugal force across the working face of the wheel.

For apparatus to carry out such method steps, I have provided a circular grinding member, such as that indicated at **10** in Figures 1 and 2, which is comprised of a grinding wheel **11** having a grinding surface, or abrasive face **12**, and supported upon a back plate **13**. The back plate has a hub **14**, which may be supported upon a spindle **15**. A circular recess **16** is provided in the axial side of said back plate remote from said wheel, said recess being co-axial with said spindle. At least one passageway **17** is provided through the back plate **13**, between the axial side thereof adjacent to said wheel **11** and the recess **16**. A liquid opening **18** is provided through said wheel **11**, between the axial faces thereof and arranged to communicate with the passageway **17**. Together, the passageway **17** and liquid opening **18** provide a passage or channel through the grinding member **10** between the recess **16** and the abrasive face **12**.

A tube **19** extends into said recess, preferably adjacent to the lower part of its peripheral wall **36** so that liquid discharged therefrom can, if desired, simply drop from the end of said tube onto said wall. Said liquid may be a coolant, an electrolyte, a lubricant, or a combination of these. The peripheral wall **36** is preferably undercut, and the passageway **17** is preferably sloped radially outwardly from a point adjacent to said wall toward said wheel **11** so that centrifugal force will cause said liquid to move from said recess **16** through the passageway **17** and opening **18** onto the abrasive face **12**. The recess **16**, the passageway **17**, the liquid opening **18**, and the tube **19** comprise a liquid feed device **20** for this particular embodiment of the invention, whereby liquid is directed to the abrasive face **12**.

Modified grinding members embodying the invention are shown at **21** in Figures 4 and 5, at **22** in Figures 7 and 8, and at **23** in Figures 10 and 11.

Detailed construction

The grinding member **10** (Figures 1 and 2), which characterizes one form of my invention, is comprised of a face-type grinding wheel **11** having an axial abrasive face **12** in a substantially conventional manner. Said face **12**, as indicated in Figure 3, may be provided by coating at least a portion of the front axial surface **27** of said wheel **11** with a relatively thin layer of abrasive material, such as diamond particles. The wheel **11** is secured to the back plate **13** by means of screws **28**, which extend through suitable openings in the wheel **11** and threadedly engage appropriate openings in said back plate **13**. The back plate **13** has a hub **14**, which extends from the rearward side **30** thereof and has a co-axial spindle opening **29**, into which the spindle **15** may be received. Said spindle **15** may be held in place with respect to the hub **14** by means of a key and keyway assembly **31**, in addition to a set screw **32** extending radially through the hub **14**. The back plate **13**, which is preferably circular, has a co-axial pilot boss **33** extending from its front face through a pilot opening **34** in the wheel **11**.

The recess **16**, which is annular in this particular embodiment (Figures 2 and 3), is spaced radially outwardly from the hub **14**. The outer wall **36** of the recess **16** is undercut and, therefore, has an expanding diameter inwardly of the rear face **30** of the back plate **13**. A plurality of relatively small passageways **17** extend between the recess **16**, adjacent to the outer wall **36** thereof, and the front face **37** of said back plate **13**. Said passageways **17** preferably diverge with respect to the axis of the back plate **13** as they extend toward the wheel **11**.

The liquid openings **18** through the wheel **11** are preferably equal in number to the passageways **17** and arranged to be aligned therewith when said wheel **11** is mounted upon the back plate **13** by means of the screws **28**. Said openings **18** are also preferably divergent with respect to the axis of the back plate as said openings extend toward the abrasive face **12**. In order to facilitate alignment of the liquid openings **18** with the passageways **17**, said passageways are provided with enlarged portions **38** adjacent to the front face **37** of the back plate **13**. Thus, liquid deposited into the annular recess **16** will be moved by centrifugal force from the recess **16** through the passageways **17**, the openings **18**, and thence into the cup-shaped recess **39** in the front surface **27** of the wheel **11**. The peripheral wall **40** of the recess **39** may be cylindrical, as appearing in Figure 2, or conical as shown at **40*a*** in Figure 3, the conical form being better adapted for moving the liquid from the recess **16** to the grinding face **12**.

Where the wheel **11** (Figures 2 and 3) has relatively porous material disposed radially outwardly of the recess **39**, the wall **40** or **40*a*** may be coated with relatively non-porous material so that all of the liquid departing the openings **18** will reach the face **12**. It also follows that such coating can be terminated at some point between the openings **18** and face **12**.

The tube or pipe **19** may be fabricated from any convenient, conventional type of material, which may be either rigid or flexible. The discharge end of said tube **19** extends into the annular recess **16**, preferably adjacent to the low point thereof, thereby permitting the liquid discharged from the tube **19** to drop onto the outer wall **36** of said recess. The tube **19** may be connected to any convenient, conventional source, not shown, of liquid, in combination with means for urging the liquid through the tube **19**. Under some circumstances, gravity alone may be sufficient to effect such urging, particularly where the liquid is used for lubrication only.

Alternate structures

As shown in Figures 4, 5 and 6, my invention may be adapted with equal facility to use with a grinding member **21** having a peripheral-type of grinding wheel **44**, which, in this particular embodiment, is shaped to provide an abrasive, circular cutting edge **45**. The wheel **44** is mounted upon a spindle **46**, which extends through a co-axial opening in said wheel. A pair of support disks **47** and **48** are also mounted upon the spindle **46**, on opposite sides of the wheel **44**, and held firmly against said wheel **44** by means of the shoulder **49** on said spindle **46** and the nut **51**, which is threadedly received upon the free end of the spindle **46**. One of said disks, here the disk **47**, is provided with a co-axial, circular recess

52 in its outer, axial face 53, which is remote from the wheel 44. The outer wall 54 of the recess 52 is undercut so that the recess 52 increases in diameter inwardly from the outer face 53 of the disk 47.

The support disks 47 and 48 (Figure 5) are provided with co-axial, annular grooves 55 and 56, respectively, in their opposing, inner faces 57 and 58, which grooves are preferably substantially the same in size and diameter. The annular groove 55 is preferably slightly larger in diameter than the circular recess 52 and is connected to said circular recess by a plurality of passageways 59 disposed adjacent to the peripheral wall 54 and diverging with respect to the axis of the spindle 46 as they extend toward the annular groove 55. A plurality of liquid openings 61 extend through the wheel 44 between the annular grooves 55 and 56.

As shown in Figure 6, the inner faces 57 and 58 of the disks 47 and 48 are provided with diametrically disposed grooves 62 and 63, respectively, which extend at least from the annular grooves 55 and 56 through the peripheries of the disks 47 and 48. Thus, liquid deposited into the circular recess 52 by the tube 64 will flow through the passageways 59 into the annular groove 55, and through the liquid openings 61 into the annular groove 56, by centrifugal force, which will then urge said liquid to move along the radial grooves 62 and 63. It makes no material difference whether the structure, which is indicated in broken lines at 65 and upon which the spindle 46 is mounted, is on the same side of the modified grinding member 21 as the circular recess 52 (Figure 6) or on the opposite side thereof (Figure 5). Where the invention is used to supply a coolant to the grinding surface of the wheel 44, it will normally be advantageous to provide a hood, as indicated in broken lines at 66 in Figure 5. In such case, the hood 66 would be provided with a suitable device, indicated at 67, for collecting, filtering and returning the liquid through the tube 64 back to the recess 52. The tube 64, circular recess 52, passageways 59, annular grooves 55 and 56, liquid openings 61 and radial grooves 62 and 63 comprise the liquid feed device 68 for the member 21.

Figures 7, 8 and 9 illustrate a modified grinding member 22 adapted for mounting directly onto present conventional equipment and without requiring even the special hub structure of the foregoing described embodiments. This embodiment includes a flared, cup-type grinding wheel 71 having a feed ring 72 and being mounted upon a conventional spindle 73, which extends through co-axial openings in the feed ring and the wheel and is provided with a conventional shoulder or collar 73*a*. Said wheel is held upon the spindle 73 and against the collar 73*a* by means of a retaining ring 74 and a nut 75, which are disposed within the cup recess 76 in a substantially conventional manner. The feed ring 72 is provided with an annular recess 77 and a plurality of passageways 78 which extend divergently from said recess 77 through said feed ring in substantially the same manner as described and disclosed hereinabove with respect to the corresponding structure in the back plate 13 (Figure 2).

The passageways 78 communicate with the adjacent ends of a plurality of correspondingly divergent liquid openings 79, which extend through the wheel 71 into the cupped recess 76 adjacent to the peripheral wall 81 thereof. Thus, fluid introduced, as by means of gravity, through the tube 82 and into the annular recess 77 will flow through the passageways 78 and fluid openings 79 onto the peripheral wall 81 and be moved by centrifugal force therealong onto the axial grinding face 83 of the wheel 71. The front ends 84 of the passageways 78 may be enlarged for the purpose of facilitating registration between the passageways 78 and the fluid openings 79. The tube 82 may be connected, in a conventional manner, to any source, not shown, of liquid, as described hereinabove with respect to the tube 19, or the tube 64. The

tube 82, recess 77, passageways 78, liquid openings 79 and peripheral wall 81 comprise the liquid feed device 85 for the member 22. The wall 81 can be coated, if desired, in the manner discussed above with respect to the walls 40 and 40*a*.

The modified, face-type grinding member 23 (Figures 10, 11 and 12) disclose a grinding wheel 90 which is like the embodiment of Figures 7, 8 and 9, adapted for direct application to present equipment. This embodiment is comprised of a circular support disk 91 having an abrasive ring 92 secured to one axial face of the said disk 91 adjacent to the periphery thereof. The support disk 91 is secured, as by means of the bolts 93 (Figure 11), to a circular feed ring 94 and the whole assembly is then mounted on the permanent back plate indicated in broken lines at 95 and which is conventionally provided on the spindle 96. The feed ring 94 is provided with an undercut, annular recess 97 in its rear face and a plurality of passageways 98 leading divergently from the recess 97 in substantially the same manner as disclosed with respect to the passageways 78 and the recess 77 in the feed ring 72 (Figure 8). The passageways 98 communicate at their front ends with a plurality of liquid openings 99 through the support disk 91 adjacent to the inner radial wall 101 of the abrasive ring 92. The support disk 91 and feed ring 94 are provided with co-axial pilot openings 102 and 103, respectively, into which the end of the spindle 96 may extend. As in the case of the grinding wheel 11 (Figure 3), the inner wall 101 of the abrasive ring 92 may be sloped radially outwardly toward the grinding face 104 to facilitate movement of liquid therealong.

The grinding wheel 90 differs from the grinding wheel 11 primarily in that the wheel 11 may be fabricated from a durable material, such as steel, upon which a thin abrasive layer 27 is coated, whereas the grinding wheel 90 has an abrasive ring 92, which is axially relatively thick. In a similar manner the grinding members 21 and 22 differ in various details from each other, and from the grinding members 10 and 23. However, all of the above described grinding members are alike in that they contain some type of circular recess in one axial face thereof, a tube extending into said recess and a plurality of passages communicating between said recess and at least one axial face of the grinding wheel.

It will be apparent that the liquid feed device 20 can be easily provided by modifying the conventional liquid feed device for a conventional face-type grinding wheel. It will also be apparent that the grinding member 10 is mounted in a substantially conventional manner upon the spindle 15, thereby avoiding the need for any special equipment or tools in adapting my invention to a conventional grinding machine.

The alternate grinding members 22 and 23 (Figures 8 and 12) are provided with liquid feed devices 85 and 105, respectively, which are substantially identical to, and operate in substantially the same manner as, the liquid feed device 20 for the grinding member 10. The liquid feed device 68 for the alternate grinding member 21(Figures 5 and 6) is substantially similar to said liquid feed device 20, except that it is adapted for use with a peripheral-type of grinding wheel 44.

The grinding member 110, illustrated in Figures 13 and 14, has a back plate 111 with a co-axial, integral hub 112 extending from the rear face 113 thereof. An annular recess 114 is provided in said rear face 113 coaxial with, and spaced from, said hub 112. Said hub 112 has an annular groove 115 near said rear face 113 in which a flexible loop 116 is snugly receivable. Said loop also encircles, and is held taut by, an idler pulley 117 located in the sump 118 of the hood assembly 119. Thus, rotation of the hub 112 causes the loop 116 to move around the pulley 117 and draw liquid from within sump 118 up to the hub 112.

A conically shaped deflector 121 is secured to the hood

assembly **119** and encircles the upper surface of the hub **112**. Said deflector diverges toward said back plate **111** and has an arcuate front edge **122** which is closely adjacent to the radially outer edge of said annular recess **114**. Thus, liquid flung from said loop, as it moves around said hub, strikes said deflector and is deflected thereby into said annular recess **114**. The recess **114**, loop **116** and liquid passages **123** through the member **110** comprise the liquid feed device **124**.

A feed control strip **125** (Figures 13, 14, 15 and 16) extends through a slot **126** in the deflector **121** directly above the loop **116**. Said strip **125** also extends through slots **127** in the hood side walls **128** for slidable support thereby. Said strip, which slopes downwardly and frontwardly, has an arcaute recess **129** in its front edge, which edge is disposed adjacent to the rear face **113** of the back plate **111**. As shown in Figure 15, the strip is slidably movable from its solid line position to its broken line position for controlling the flow of liquid into the recess **114**. The tabs **130** on the ends of the strip **125** prevent its dislodgement from the hood and automatically locate its fully open and fully closed positions, the latter being in solid lines in Figure 15.

Operation

Attention is now directed specifically to the operation of the devices above described and simultaneously to the method of the invention as illustrated by, but not confined to, such operations.

Attention is now directed specifically to the operation of the devices above described and simultaneously to the method of the invention as illustrated by, but not confined to, such operations.

Referring first to the liquid feed device **20** (Figures 1 and 2), liquid deposited in the recess **16** by the tube **19** will be moved, when the wheel **11** is being rotated, by centrifugal force through the passageways **17**, the liquid openings **18** and along the outer wall **40** of the cup recess **39** to the abrasive face **12**. Such liquid can be supplied through the tube **19** at any desired rate, ranging from a few drops a minute up to a steady stream, without encountering splashing or any of the other undesirable problems created by present equipment designed for the same or similar purposes. Even though the wall **40** is substantially parallel to the axis of the shaft **15**, any given increment of liquid on the wall **40** will be forced along by the pressure immediately behind such increment, with such pressure originating in the passageways **18**.

In the embodiment of Figure 3, liquid is supplied to the groove **16** in the same manner as in the embodiment of Figure 2 and is somewhat distributed circumferentially around said groove. It then travels by centrifugal force to the annular groove **38** where it is distributed further around the circumferential length of said groove and then travels by centrifugal force through the passageways **18** to the wall **40***a*. The wall **40***a*, being somewhat outwardly flared, provides a more rapid and easier path for the liquid to travel by centrifugal force to the face **12**, than is the case with wall **40** in Figure 2. This embodiment will accordingly be used where a more rapid supply of liquid is desired at the face **12** than is possible with the construction of Figure 2.

In the embodiment of Figures 7, 8 and 9, the liquid is supplied by gravity through the pipe **82** into the annular groove **77** and passes through the passageways **78** into the annular groove **84**, where it is further distributed circumferentially and then passes to the several passageways **79**. Centrifugal force then continues to carry the liquid through the passageways **79** and along the face **81** of the wheel to the working face **83** where it spreads radially in response to further centrifugal force in the desired manner.

In the modification appearing in Figures 10, 11 and 12, liquid supplied, either under pressure or by gravity through the pipe **105** will be deposited in the circumferential groove **97** whence it will pass through the openings **98** into the circumferential groove **100**, in which it will be distributed further circumferentially and will then pass through the openings **99** in response to the pressure developed in the radially divergent groove **98** to and along the face **101** until it reaches the working face **104**. At this point it will spread radially outwardly in response to centrifugal force and will do so with sufficient rapidity to keep the working surface properly supplied.

It will be observed that the grinding members **10**, **21**, **22** and **23** permit the adaptation of a conventional dry-type of grinding machine into a liquid-type of grinding machine, without necessitating any changes in said machine, since the entire liquid feed device **20**, **68**, **85** and **105**, respectively, can be completely independent of the remainder of the machine. Where the grinding machine is of the type having a liquid feed device of some kind, said machine can be easily and quickly adapted to use with my invention by connecting the tube **19**, for example, to the liquid supply of the machine and then mounting an appropriate grinding member, such as the grinding member **10**, upon the spindle of the machine.

The liquid feed device **124** (Figure 13 and 14), wherein a belt or loop **116** is utilized to move the liquid to the grinding member, will meet at least some of the objectives of the invention. Said loop provides a satisfactory means of supplying the liquid to the grinding member where a pressure operated, circulating system is not feasible and something less than complete control of the liquid is acceptable. As the loop passes around the pulley **117** in the sump **118**, it picks up liquid which adheres to said loop as it moves upwardly toward the hub **112**. However, centrifugal force causes the liquid to fly off the loop, as it goes around said hub, and strike against the deflector **121** from and by which it is directed into the recess **114** in said back plate **111**, unless the strip **129** is blocking the liquid. Centrifugal force then causes the liquid to pass through the passages **123** to the grinding face of the member **110** in the manner described in detail with reference to the operation of the liquid feed device **20** (Figure 2).

By sliding the strip **125** laterally, the amount of liquid moving from the loop **116** against the deflector **121** can be accurately and instantly controlled. When the strip is in its broken line position (Figure 15), the liquid passes through the recess **129** and is substantially unrestricted by the strip **125**. When the strip is moved away from this broken position, the amount of said liquid moving into said recess **114** is steadily decreased until it is substantially stopped when the strip is in said solid line position of Figure 15.

Although particular, preferred embodiments of the invention have been described hereinabove in detail for illustrative purposes, it will be understood that variations or modifications thereof, which do not depart from the scope of the invention, are fully contemplated unless specifically stated to the contrary in the appended claims.

I claim:

1. A device for conveying liquid into an annular recess in one axial face of a disk rotatable about a substantially horizontal axis, comprising: circular means co-axial with said disk and mounted upon said axial face; a liquid reservoir below said circular means; a flexible loop encircling said circular means and movable with said disk, said loop extending into said reservoir; and an arcuate member above said circular means and adjacent to said disk, said member being arranged to deflect into said recess the liquid flung by centrifugal force from said loop as it passes around said circular means.

2. The structure of claim 1 including an elongated, flat strip slidably disposed between the liquid deflecting surface of said arcuate member and said circular means,

and arranged for controlling the movement of said liquid from said loop into said recess.

3. In a grinding machine, the combination comprising: a grinding wheel mounted upon a substantially horizontal, rotatable spindle; a back plate mounted on said spindle adjacent one side of said wheel; means defining an annular recess in the side of said plate remote from said grinding wheel, said recess being coaxial with said spindle, said back plate having circumferentially spaced passageways extending from said recess to said one side of said wheel, said passageways at least in part diverging with respect to the axis of said spindle, said grinding wheel having openings therethrough aligned with said passageways, said openings communicating with the other side of said grinding wheel, said grinding wheel having a non-porous coating on the surface thereof between said openings and the grinding face of said wheel; means for supplying fluid to said recess, whereby such fluid may move from said recess through said passageways and said openings and along said coating to the grinding face of said grinding wheel.

4. A grinding machine as set forth in claim 3, wherein said recess has a radially inwardly directed lip on its radially outer wall and said fluid supply means is a conduit which extends within said recess and directs fluid downwardly therewithin.

5. A grinding machine as set forth in claim 3, including: a hub extending from, and integral with, the side of said plate remote from said grinding wheel, said hub being coaxial with, and surrounding, said spindle; an annular groove in said hub near said plate; a liquid reservoir below said hub; a flexible loop received within the groove in said hub and extending into said reservoir; and an arcuate member above said hub and adjacent to said plate, said member being arranged to deflect into said recess the liquid flung by centrifugal force from said loop as it passes around said hub.

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